CALIFORNIA
Water Boards

Edmund G. Brown Jr.
Governor

Matthew Rodriquez
Secretary for
Environmental Protection

Central Coast Regional Water Quality Control Board

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Via Electronic Mail

DATE: August 27, 2012

TO: Emel Wadhwani
Staff Counsel
State Water Resources Control Board/Office of Chief Counsel

FROM: Michael Thomas
Assistant Executive Officer
CENTRAL COAST REGIONAL WATER QUALITY CONTROL BOARD

SUBJECT: IN THE MATTER OF PETITIONS OF OCEAN MIST FARMS AND RC FARMS; GROWER-SHIPPER ASSOCIATION OF CENTRAL CALIFORNIA, GROWER-SHIPPER ASSOCIATION OF SANTA BARBARA AND SAN LUIS OBISPO COUNTIES, AND WESTERN GROWERS, ORDER NO. R3-2012-0011, CONDITIONAL WAIVER OF WASTE DISCHARGE REQUIREMENTS FOR DISCHARGERS FROM IRRIGATED LANDS AND ORDER NOS R3-2012-0011-01, R3-2012-0011-02, AND R3-2012-0011-03 MONITORING AND REPORTING PROGRAMS: SUMMARY OF CENTRAL COAST WATER BOARD TESTIMONY REQUESTING DISMISSAL OF STAY REQUEST, SWRCB/OCC FILES A-2209(C) AND (D).

The State Water Resources Control Board's Notice of Public Hearing dated August 21, 2012, provided that a hearing will be held on August 30, 2012 to consider issuance of a stay of certain provisions of Order No. R3-2012-0011, Conditional Waiver of Waste Discharge Requirements for Dischargers from Irrigated Lands and the accompanying Monitoring and Reporting Program Orders (hereafter collectively referred to as 2012 Order). As invited by the State Water Resources Control Board (State Water Board) in the notice, the Central Coast Regional Water Quality Control Board (Central Coast Water Board or Water Board) hereby submits the following: (a) list of witnesses, (b) summary of testimony and written responses to the questions posed under section "ISSUES TO BE ADDRESSED", (c) powerpoint presentation, and (d) list of physical evidence and exhibits that the Central Coast Water Board wishes to introduce into the record and intend to use at the hearing in opposition to the stay requests by the Petitioners at the hearing to be held on August 30, 2012.

The Central Coast Water Board's information below regarding the stay request is limited to the narrow set of issues identified in the notice to assist the State Water Board in its determination of whether to grant Petitioners' request that certain provisions of the 2012 Order be stayed.

If you have any questions, please contact Frances McChesney by phone at (916) 341-5174 or by email at fmcchesney@waterboards.ca.gov, or Michael Thomas by phone at (805) 542-4623 or by email at mthomas@waterboards.ca.gov.

cc:

Note: The Central Coast Water Board is providing our documents to the parties to the hearing by the following link on the Central Coast Water Board's website:
http://www.waterboards.ca.gov/centralcoast/water_issues/programs/ag_waivers/ag_order.shtml

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CENTRAL COAST WATER BOARD
WRITTEN RESPONSES AND SUMMARY OF TESTIMONY
REQUESTING DISMISSAL OF STAY REQUEST
LIST OF WITNESSES, POWERPOINT PRESENTATION, LIST OF PHYSICAL EVIDENCE AND EXHIBITS: SWRCB/OCC FILES A-2209(C) AND (D)

I. LIST OF WITNESSES

Central Coast Water Board Assistant Executive Officer Water Resources Control Engineer	Michael Thomas
Central Coast Water Board Senior Engineering Geologist Agricultural Regulatory Program Manager and Supervisor Registered Geologist	Angela Schroeter
Central Coast Water Board Staff Water Resources Control Engineer Certified Crop Advisor, Certified Irrigation Designer B.S. Agronomy, M.S. General Agriculture	Monica Barricarte

II. OTHER CENTRAL COAST WATER BOARD REPRESENTATIVES

Central Coast Water Board Chair [Will be providing introduction and policy statement.]	Jeff Young
State Water Resources Control Board Office of Chief Counsel	Frances McChesney
State Water Resources Control Board Office of Chief Counsel	Jessica Jahr

III. SUMMARY OF TESTIMONY AND WRITTEN RESPONSES TO THE QUESTIONS POSED UNDER SECTION "ISSUES TO BE ADDRESSED"

Stay Request

State Water Board regulations recognize the extraordinary nature of a stay remedy and place a heavy burden on the seeker of the stay.[1] In order to issue a stay of all or certain provisions of Order No. R3-2012-0011 and the accompanying Monitoring and Reporting Program Orders (hereafter 2012 Order), the State Water Board must find that the Petitioners have alleged facts and produced proof of: (1) substantial harm to the Petitioners or to the public interest if a stay is not granted; (2) a lack of substantial harm to other interested persons and to the public interest if a stay is granted; and (3) substantial questions of law or fact regarding the disputed action.[2] It is incumbent on the Petitioners to meet all three prongs of the test before a stay may be granted.[3] In addition, the issue of whether a stay is appropriate must be judged in the temporal sense – the Petitioners must prove that they will suffer substantial harm if a stay is not granted

[1] See State Water Board Order WQ 97-05 (*Ventura County Citizens*) at page 4.
[2] See California Code of Regulations, Title 23, § 2053.
[3] See State Water Board Order WQO 2002-0007 (*County of Los Angeles, et al*.).

for the period of time pending resolution of the petition on the merits.[4] The issue before the State Water Board is *not* whether the Petitioners might prevail on any of the merits of its claims, or whether the Petitioners will suffer harm over the term of the Order.

In summary, the Central Coast Water Board requests that the State Water Board deny the Petitioners request for a stay of provisions of the 2012 Order for the following specific reasons:

1. **There is no substantial harm to the Petitioners or the public if the stay is not granted.** The costs to growers enrolled in the Order are reasonable given the existing and potential severe water quality impairments associated with the discharges. The cost estimates presented herein reflect the actual requirements in the 2012 Order, the Central Coast Water Board's expectations regarding compliance with the requirements, and the fact that the previous Order No. R3-2004-0117[5] adopted in 2004 (2004 Order) included substantial and similar requirements. The extraordinary costs alleged by Petitioners are not based on the actual requirements in the 2012 Order, or the Central Coast Water Board's expectations regarding compliance, and do not account for the substantial and similar requirements in the Central Coast Water Board's 2004 Order and the work that should have been done to comply with the 2004 Order. The provisions included in the 2012 Order that are challenged by the Petitioners Request for Stay are standard practices recommended by the University of California Cooperative Extension (UCCE) and Natural Resources Conservation Service (NRCS), and implemented routinely by growers. The costs through the end of 2013 are necessary to comply with specific provisions of the 2012 Order, are limited, and do not similarly affect all growers enrolled in the 2012 Order. The range of costs to enrolled growers depends on the farm-specific characteristics, level of discharge, threat to water quality, and how well dischargers complied with the 2004 Order in implementing management practices to achieve water quality standards. If a discharger did little to comply with the 2004 Order, their cost to comply now will be much higher than it otherwise would be had the grower implemented effective management practices as required by the 2004 Order. However, noncompliance and the resulting deferral of costs are not a defensible reason for a Stay.

2. **There is substantial harm to other interested persons and to the public interest if the stay is granted,** especially in rural communities whose drinking water is severely impacted by the agricultural discharges to groundwater (nitrate), and the public and individuals who are affected by impairments to surface water bodies (toxicity, pesticides, nutrients, sediment/turbidity, temperature). Existing and potential water quality impairment takes on added significance and urgency given the impacts on public health, limited sources of drinking water supplies and proximity of the Central Coast region's agricultural lands to critical habitat for species of concern. Groundwater nitrate contamination brings two forms of susceptibility: public health risks and the economic costs of avoiding such risks through treatment, source reduction, remediation, or alternative water supplies. The Central Coast Region is particularly susceptible to public health and financial risks from nitrate contamination because the Salinas Valley and similar agricultural areas have many poor communities that cannot afford drinking water treatment or capital-intensive alternative water supplies. The application of fertilizer on a landscape scale is immense, resulting in substantial pollutant loading to groundwater and drinking water supplies. The increasing health threat and economic cost is critical in

[4] See *id.*
[5] Note that the 2004 Order was renewed multiple times by the Central Coast Water Board or the Executive Officer without revision during the public process that lead to adoption of the 2012 Order.

both the short-term and the long-term. The estimated annual cost to ensure safe drinking water for a self-supplied household can cost from $250 to $185,500and the annual cost for a small community public water system ranges from $40,000 to $15.1 Million.[6] These costs are also discussed in Appendix F of the Staff Report for Board Meeting Item 14, March 2011, Central Coast Water Board.

3. **There are no substantial questions of fact or law regarding the Order.** The Porter-Cologne Water Quality Control Act (Porter-Cologne Act) grants authority to the Regional Water Boards to regulate discharges of waste that could affect the quality of waters of the State and to adopt water quality regulations and policy. Dischargers of waste are required to obtain waste discharge requirements or a waiver and comply with requirements to protect the beneficial uses of waters of the state. The Central Coast Water Board complied with the Porter-Cologne Act and applicable policies and regulations in adopting the renewed waiver. The Central Coast Water Board engaged in a lengthy public process to update the Order, complied with the California Environmental Quality Act (CEQA), and adopted an Order that is consistent with applicable plans and policies adopted by the State Water Board and Central Coast Water Board, including but not limited to the Water Board's Policy for Implementation and Enforcement of Nonpoint Source Pollution Control Program and the Central Coast Water Board's Water Quality Control Plan for the Central Coast Region (Basin Plan). The process to renew the 2004 Order began in August 2008 and has been the most extensive public process in the history of the Central Coast Water Board – including five draft orders and associated staff reports, six public comment periods, six public workshops and hearings before the Board, over 60 outreach events and many discussions with stakeholders. The Central Coast Water Board invited interested persons to submit alternative proposals for consideration and staff made hundreds of changes to the initial draft order in response to comments from agricultural organizations.

Background

The Central Coast Region has approximately 435,000 acres of irrigated land and produces many high value specialty crops including lettuce, strawberries, raspberries, artichokes, asparagus, broccoli, carrots, cauliflower, celery, fresh herbs, mushrooms, onions, peas, spinach, wine grapes, tree fruit, and nuts. The 2012 Order updates the 2004 Order and sets forth conditions consistent with Water Code section 13269 that apply to discharges of waste from irrigated lands, where water is applied for producing commercial crops.

Discharges of waste associated with agricultural discharges (e.g., pesticides, sediment, nutrients) are a major cause of water pollution in the Central Coast Region, as detailed in the 2012 Order (Findings 5-8; Attachment A – Additional Findings 1, 27, 33-133), and the March 17, 2011 staff report to the Board (see staff report and Appendix G – Report on Water Quality Conditions). The water quality impairments are well documented, severe, and widespread. Nearly all beneficial uses of water are affected, and many agricultural waste discharges continue to contribute to already significantly impaired water quality and impose certain risks and significant costs to public health, drinking water supplies, aquatic life, and valued water resources.

[6] Harter, T. et al. UC Davis Groundwater Nitrate Project, Implementation of Senate Bill X2 1 Prepared for California State Water Resources Control Board January 2012. Addressing Nitrate in California's Drinking Water. Table 14 Safe drinking water option costs for self-supplied household and small community public water systems. http://groundwaternitrate.ucdavis.edu/

Discharges from irrigated lands regulated by the 2012 Order include discharges of waste to surface water and groundwater. The 2012 Order classifies farms/ranches into one of three Tiers. The requirements for each Tier vary based on level of discharge and risk to water quality, and there are options and alternatives to comply based on the specific characteristics of an individual farm. For many farms (Tier 1 and Tier 2), the 2012 Order requirements are similar or less stringent than the previous 2004 Order. Farms in Tier 3 present a relatively higher level of risk to water quality and therefore have more stringent requirements.

As of August 2012, approximately 4129 farms/ranches, representing approximately 399,494 irrigated acres are enrolled in the 2012 Order. Of these farms/ranches, approximately 3680 farms/ranches (89% of the total farms/ranches enrolled) representing approximately 366,231 irrigated acres (91% of the total acres enrolled) have a completed electronic-Notice of Intent (eNOI) in the Water Board's GeoTracker data management system that can be used for tier assignment[7]. The remaining farms/ranches have not complied with the requirement to submit an updated eNOI or have not submitted sufficient information for tier assignment. Table 1 below includes the approximate number of farms and acreage in each Tier based on completed eNOI data in GeoTracker.

Table 1. Estimated number of farms and acreage in Tier 1, Tier 2, and Tier 3 based on eNOI data in GeoTracker as of August 2012.

	TIER 1	TIER 2	TIER 3	Total
Number of Farms/Ranches	2024	1546	110	3680
Number of Acres	142,010	183,632	40,588	366,231

III. ISSUES TO BE ADDRESSED

Issue 1: Costs to Comply

The State Water Board instructed parties to provide cost estimates, and the underlying assumptions for those cost estimates, for specific actions through the end of 2013 necessary to comply with certain provisions in the 2012 Order. Each provision is addressed separately in this testimony, below.

Response 1:

It is essentially impossible for Central Coast Water Board to estimate actual costs to individual growers due to the following variables across 4,129 farms/ranches enrolled in the 2012 Order:

The degree to which individual growers complied with the 2004 Order

[7] Enrollment information in the Water Board's GeoTracker data management system as of Aug. 1, 2012.

The diversity of irrigated agriculture in the Central Coast Region
The variation in site-specific environmental conditions
The site-specific applicability of management practices
The flexible compliance options in the 2004 Order and the 2012 Order
The degree to which growers utilize low costs or free technical services
The degree to which growers participate in and utilize grant projects

Therefore, we consider costs in relative terms. Any consideration of costs must account for work that growers were required to do to comply with the 2004 Order and how that work directly relates to the 2012 Order. We do not attempt to estimate costs for growers who did not comply with the 2004 Order over the past 8 years, and who now believe they must implement substantial practices and report effective results in the near term (through 2013) to comply with the 2012 Order. Such cost estimates would be deferred costs due to non-compliance, and are not valid.

The 2012 Order was built upon the 2004 Order. The first sentence of the first finding in the 2004 Order states:

"The intent of this Conditional Waiver is to regulate discharges from irrigated lands to ensure that such discharges are not causing or contributing to exceedances of any Regional, State, or Federal numeric or narrative water quality standard."

Finding 2 of the 2004 Order states:

"Discharges include surface discharges (also known as irrigation return flows or tailwater), subsurface drainage generated by installing drainage systems to lower the water table below irrigated lands (also known as tile drains), discharges to groundwater through percolation, and storm water runoff flowing from irrigated lands. These discharges can contain wastes that could affect the quality of waters of the state."

Finding 43 of the 2004 Order states:

Basin Plan – The Regional Board adopted the Water Quality Control Plan, Central Coast Basin (Basin Plan) on September 8, 1994. The Basin Plan incorporates State Board plans and policies by reference and contains a strategy for protecting beneficial uses of surface and ground waters throughout the Region. This conditional waiver requires Dischargers to comply with all applicable provisions of the Basin Plan.

Finding 45 of the 2004 Order includes this statement:

Dischargers must comply with all applicable provisions of the Basin Plan, including water quality objectives, and implement best management practices to prevent pollution or nuisance and to maintain the highest water quality consistent with the maximum benefit to the people of the State.

Finding 46 of the 2004 Order:

The goal of this Order and Conditional Waiver is to improve and protect water quality by providing a program to manage discharges from irrigated lands that cause or contribute to conditions of pollution or nuisance as defined in Section 13050 of the California Water

Code or that cause or contribute to exceedances of any Regional or State Board numeric or narrative water quality standard by reducing discharges of waste.

The 2004 Order also states:

Dischargers shall take action to comply with the terms and conditions of the waiver adopted by this Order and improve and protect waters of the state.

The 2004 Order defines a Farm Water Quality Management Plan as follows:

Farm Water Quality Management Plan (Farm Plan) - a document that contains, at a minimum, identification of practices that are currently being or will be implemented to address irrigation management, pesticide management, nutrient management and erosion control to protect water quality. Plans will contain a schedule for implementation of practices. Lists of water quality protection practices are available from several sources, including the University of California farm plan template available from the University of California.

The 2004 Order also states:

All applicants must submit the following information as part of their Notice of Intent (NOI) to enroll:

- *Completed application form, including location of the operation and identification of responsible parties (owners/operators)*
- *Copy of map of operation (map should be the same as the one submitted to the County Agricultural Commissioner for Pesticide Use Reporting, or equivalent)*
- *Completed management practice checklist/self assessment form*
- *Certificates of attendance at Regional Board-approved farm water quality education courses, if applicable*
- *Statement of farm water quality plan completion, if applicable*
- *Election for cooperative or individual monitoring*

The 2004 Order also included the following reporting requirements:

<u>Tier 1 Qualifications and Reporting Requirements</u>
Tier 1 conditional waivers will be five years in length. To qualify for a Tier 1 conditional waiver, Dischargers must do the following:

a. *complete 15 hours of Regional Board-approved farm water quality education by the enrollment deadline*
b. *complete a Farm Plan by the enrollment deadline*
c. *provide a biennial practice implementation checklist to the Regional Board demonstrating that the Discharger is implementing the Farm Plan, or that the Discharger has made and is implementing appropriate changes to the Farm Plan*
d. *perform individual water quality monitoring or participate in cooperative water quality monitoring*

Tier 2 Qualifications and Reporting Requirements

Tier 2 conditional waivers will be one year in length, renewable up to three years. To qualify for a Tier 2 conditional waiver, operations must do the following:

a. *complete at least 5 hours of Regional Board-approved water quality education per year, up to a total of at least 15 hours (the first 5 hours may be completed after enrollment)*
b. *complete a Farm Plan within three years of the enrollment deadline*
c. *provide annual practice implementation checklists identifying currently implemented and planned management practices and progress reports on completion of requirements to the Regional Board*
d. *perform individual water quality monitoring or participate in cooperative water quality monitoring*

The 2004 Order also states the following conditions for all waiver holders:

1. *The Discharger shall not cause or contribute to conditions of pollution or nuisance as defined in CWC Section 13050.*

2. *The Discharger must comply with all requirements of applicable water quality control plans.*

3. *The Discharger shall not cause or contribute to exceedances of any Regional, State, or Federal numeric or narrative water quality standard.*

4. *Wastewaters percolated into groundwater shall be of such quality at the point where they enter the ground so as to assure the protection of all actual or designated beneficial uses of all groundwaters of the basin.*

5. *Wastes discharged to groundwater shall be free of toxic substances in excess of maximum contaminant levels (MCLs) for primary and secondary drinking water standards established by the United States Environmental Protection Agency or California Department of Health Services, whichever is more stringent; taste, odor, or color producing substances; and nitrogenous compounds in quantities which could result in a groundwater nitrate concentration (as NO_3) above 45 mg/l.*

6. *The Discharger shall comply with each applicable Total Maximum Daily Load (TMDL), including any plan of implementation for the TMDL, commencing with the effective date or other date for compliance stated in the TMDL. If an applicable TMDL does not contain an effective date or compliance date, the Discharger shall commence compliance with the TMDL's implementation plan no later than twelve months after USEPA approves the TMDL.*

7. *The Discharger shall comply with applicable time schedules.*

8. *This Conditional Waiver does not authorize the discharge of any waste not specifically regulated under this Order. Waste specifically regulated under this Order includes: earthen materials, including soil, silt, sand, clay, rock; inorganic materials including metals, salts, boron, selenium, potassium, nitrogen, phosphorus, etc.; and organic materials such as pesticides that enter or threaten to enter into waters of the*

state. Examples of waste not specifically regulated under this Order include hazardous materials, and human wastes.

9. *Objectionable odors due to the storage of wastewater and/or stormwater shall not be perceivable beyond the limits of the property owned or operated by the Discharger*.

The 2004 Order clearly required the implementation of management practices to achieve water quality standards, including irrigation management practices, pesticide management practices, nutrient management practices, and erosion control practices to protect water quality, all of which should have been described in Farm Water Quality Management Plans (Farm Plans) with implementation schedules. Thus, these types of requirements and the costs associated with them are not new. The 2004 Order also required education, monitoring, and reporting.

During the many Board workshops for the 2012 Order, farmers and farm representatives stated repeatedly that the majority of farmers were already implementing all or nearly all management practices as required by the 2004 Order. For example, in a March 25, 2010 comment letter to the Central Coast Water Board, the President of R.C. Farms LLC indicated that *"We have been operating for the last 5 and one-half years under the current Ag Waiver. We have and are implementing management practices to be in compliance with that waiver."* In a similar comment letter dated March 30, 2010, the Santa Barbara County Farm Bureau stated *"Our members supported the initial Conditional Ag Waiver that your Board adopted in 2004…They participated in numerous education and outreach programs along with the development and implementation of Farm Plans that focused on the management of their distinct operations."* In another comment letter dated April 1, 2010, representatives of Grower-Shipper Association of Santa Barbara and San Luis Obispo Counties state *"In fact, many growers in the Central Coast have changed cultural practices to better protect water quality".* The record contains literally hundreds of letters from growers with similar statements.

In addition, farmers reported the practices they were implementing in management practice checklists summarized by the Water Board in the 2006 Management Practice Checklist Summary Report[8]. If the information submitted to the Water Board was false, or if farmers did not comply with the 2004 Order, such events cannot be used as justification for "new" costs.

Most of the provisions of the 2004 Order and the 2012 Order are based on standard management practices promoted routinely by the University of California Division of Agriculture and Natural Resources (UCANR), University of California Cooperative Extension (UCCE), the U.S. Department of Agriculture - Natural Resources Conservation Services (NRCS) and many agricultural industry groups. Hence, the source of cost information previously reported in the record for the 2012 Order and referred to in responses are taken from information developed by these organizations. Cost information from these sources and other agricultural technical consultants are summarized in Table 4 and Table 5, page 17, Appendix F, Staff Report for Board Meeting Item 14, March 2011, Central Coast Water Board.

The Water Board developed the 2012 Order, such that in general the provisions apply to specific farms based on the provision either being specific to one or two of the three Tiers or because the provision is specific to water quality protection for a certain farm location (e.g., adjacent to an already impaired creek), or operational characteristics (e.g., apply fertilizer through an irrigation system). In addition, most of the provisions include alternatives to the

[8] Central Coast Water Board. June 2007. 2006 Management Practice Checklist Summary Report.

primary action to comply with the provision, providing flexibility for growers to implement the most appropriate and least costly management practice that will effectively reduce pollutant loading and eventually achieve compliance with water quality standards in their given situation. Many provisions are ongoing and iterative, and do not have a specific completion date. In these cases, growers are required to initiate actions but are not required to complete the actions by 2013. The cost estimates discussed below assume that the grower has complied with the 2004 Order, has been and is currently implementing management practices, and is evaluating the effectiveness of those management practices, and can therefore continue this work in a reasonable manner and report the results to the Water Board.

There is wide range of potential costs for growers to comply with specific provisions in the 2012 Order. The Water Board cannot estimate the wide range of costs that growers are facing, depending on their situation (ranging from complete non-compliance with the 2004 Order to comprehensive approaches beyond the requirements of the 2012 Order). The variability of farm characteristics and variety of approaches and alternatives and flexibility in the 2012 Order make such a cost estimate impossible. The cost estimates described below are based on the Central Coast Water Board's expectations for what growers need to do to comply through the end of 2013, assuming that growers have complied with the 2004 Order.

It should also be noted that numerous grant funding programs have existed and continue to exist to support agricultural water quality improvement. For example, the State Water Board has made more than $600 Million of public grant funds available from 2000 – 2011 to address agricultural water quality issues. In the Central Coast region specifically, the State Water Board awarded more than $55 Million in grants funds to agricultural related projects. Most recently, the Water Board awarded approximately $3 Million in Proposition 84 grant funds for local Resource Conservation Districts (RCDs) to implement irrigation and nutrient management practices in agricultural areas of the Central Coast Region to reduce nitrate loading to groundwater and surface water. In addition, the Central Coast Water Board is in the process of making $10,000 in grant funds available to assist small farms and financially disadvantaged growers to conduct required groundwater monitoring and reporting. There are also many public and non-profit resources available to the agricultural industry to share technical assistance for pollution prevention and to address water quality problems associated with irrigated agriculture, including NRCS, RCDs, and UCCE. These resources can often provide low-cost assistance, grant funding, and cost-share funding for implementation of management practices to help reduce costs to growers.

In addition, the costs estimates submitted by Petitioners cannot reasonably be used to make decisions regarding a Stay. Legitimate cost estimates to show substantial harm should be determined by a qualified, objective, third party, and must account for work that should have been done to comply with the requirements of the 2004 Order. The resulting cost estimates should then be compared to revenues and profits. For example, Mr. William Thomas's declaration, on behalf of Ocean Mist Farms, states that it will cost Ocean Mist Farms ~$50 to $100/acre to comply with the 2012 Order through 2013. This may be a reasonable to cost to pay to protect water quality, but there is no way of knowing because no valid cost analysis has been done. The Central Coast of California is one of the most profitable agricultural regions in the nation. For Monterey County alone, the 2011 Monterey County Crop Report calculated total crop values of $3,852,995,000[9]. The Crop Report reported a 2011 crop value of $ $49,331,000 for artichokes, a primary crop produced by Ocean Mist Farms. Spread over a reported 4992

[9] County of Monterey Agricultural Commissioner. 2011 Monterey County Crop Report. http://ag.co.monterey.ca.us/assets/resources/assets/252/cropreport_2011.pdf

acres, artichokes had a 2011 crop value of $9,882/acre. Without a comprehensive and objective analysis that compares objective cost estimates to revenue and profit, there is no showing of substantial harm. Also, the resulting actual cost estimates must then be compared to the extraordinary costs to society for the increasingly severe surface water and groundwater pollution problems caused by irrigated agriculture.

Summary of Central Coast Water Board Cost Estimates

Table 2, below, is a summary list of costs for the specific provisions identified in the Hearing Notice. For the purpose of this hearing, as per the Hearing Notice, new costs (identified in **BOLD** below) are for new actions that must be done in 2013.

Table 2. Summary of costs for specific provisions defined in the Hearing Notice for this proceeding (new costs are identified in **BOLD** are for new actions that must be done in 2013.)

No.	**Provision**	**Estimated Cost per Farm**
31	**Backflow prevention devices**	**$0 - $435**
33	Maintenance of containment structures	$0 - $1440
39	Maintenance of riparian vegetative cover and or riparian areas	$0
44(g)	Practice effectiveness and compliance reporting	$0 - $3600
51	**Groundwater monitoring**	**$0 if no groundwater wells on farm** **$400 - $1200 for Tier 1 and Tier 2** **$600 - $1800 for Tier 3**
67	Annual compliance form reporting	$0 – $1440 for Tier 2 and Tier 3
68	**Determination of nitrate loading risk factors and determination of total nitrogen applied**	**$0 – $720 for Tier 2 and Tier 3**
69	**Photo monitoring**	**$0 - $1440 per half-mile of stream for Tier 2 and Tier 3**
72, 73	**Individual surface water discharge monitoring and reporting**	**$0 if no discharge** **$6,301 to $8551 for Tier 3 Only**

For Tier 1 farms, the estimated range in total cost for the specific provisions identified in the Hearing Notice is $0 - $6675.

For Tier 2 farms, the estimated range in total cost for the specific provisions identified in the Hearing Notice is $0 - $10,275.

For Tier 3 farms, the estimated range in total cost for the specific provisions identified in the Hearing Notice is $0 - $19,426.

The cost range could be much higher than the estimates above depending on the degree to which growers did not comply with the 2004 Order. We do not attempt to provide estimates for this situation.

Specific Cost Estimates and Assumptions

Cost estimates, and the underlying assumptions for those cost estimates, for specific actions through the end of 2013 necessary to comply specific provisions are summarized in the tables below and discussed in more detail in the subsequent text.

Issue 1A: Installation of back flow prevention devices (Provision 31)

Applicability	Applies to subset of Tier 1, 2 and 3 farms that chemigate or fertigate. (precise number of farms unknown)
Due Date	October 1, 2012
Purpose	To prevent fertilizers and pesticides applied through an irrigation system from flowing directly back down a groundwater well or to surface water causing pollution.
Threat to water quality	High
Estimated Range of Costs for Growers to Comply (2013)	$0 - $435 per farm
Factors Affecting Cost to Growers	Not all growers fertigate or chemigate (apply fertilizers or chemicals through an irrigation system). Growers who do must already comply with backflow prevention requirements required for chemigation by Department of Pesticide Regulation (DPR). Between 66-77% of growers who submitted a management practice checklist to comply with the 2004 Order reported already having adequate backflow prevention. Thus, there are likely only a limited number of growers who would have to incur new costs by installing backflow prevention devices for fertigation to comply with Provision 31.
Cost to the public for non-compliance	Costs to municipalities, water purveyors, and homeowners to deal with polluted groundwater are in the millions of dollars over time. Contamination of groundwater is critically important to nearby residents who use domestic wells.

Provision 31 of the 2012 Order requires growers that apply fertilizers, pesticides, fumigants or other chemicals through an irrigation system to have functional and properly maintained back flow prevention devices. This provision applies to the subset of Tier 1, 2 and 3 farms that fertigate or chemigate. The use of backflow prevention devices is a standard industry practice recommended by the University of California Division of Agriculture and Natural Resources (UCANR) as a specific "Management Goal " identified as "the best economically achievable technology or process for limiting the movement of nutrients, particularly nitrogen and phosphorus, into ground or surface waters".[10][11] In addition, existing DPR regulation already

[10] Pettygrove, G.S., T. Hartz, R. Smith, T. Lockhart, B. Hanson, L. Jackson, and S. Grattan. 2003. Farm Water Quality Plan Fact Sheet 3.4. Nutrient Management Goals and Management Practices for Cool-Season Vegetables. UCANR Publication 8097.

[11] NRCS Conservation Practice Standard, Irrigation Water Management, Code 449, May 2011.

requires backflow prevention devices for chemigation (Section 6610 of Title 3 of the California Code of Regulations).

The cost of this action ranges from $0 - $435 per farm, as a one-time cost. Growers who have already installed backflow prevention devices as a standard practice or in compliance with existing DPR regulation do not incur new costs. Growers who newly initiate fertigation would need to install backflow prevention devices. The amount of $435 is the estimated cost for growers who need to install new backflow prevention devices for fertigation. These cost estimates were based on information provided by Pacific Ag Water in Santa Maria, CA (who provide professional irrigation system and equipment services) and documented at page 19, Table 5, Appendix F, Staff Report for Board Meeting Item 14, March 2011, Central Coast Water Board.

Based on data reported by growers for the 2006 Management Practice Checklist, approximately 66% of the growers who submitted the checklist reported they use chemigation and had a backflow prevention device. Similarly, 71% of the growers who submitted the checklist reported that they use fertigation and had measures in place to ensure that there is not backflow into wells or other sources. Thus, there are likely only a limited number of growers who would have to incur new costs to comply with Provision 31. Cost will be less for growers who share a primary irrigation system; in these cases the same cost of the device would be shared by multiple farms. In other cases, larger farms may have increased cost if they have multiple irrigation systems used for fertigation.

Issue 1B. Maintenance of containment structures (Provision 33)

Applicability	Applies to subset of Tier 1, 2 and 3 farms that have at least one containment structure. (precise number of farms unknown)
Due Date	Growers are required to continue or initiate actions, but are not required to complete any specific action by 2013. This requirement was in the 2004 Order. This is not new.
Purpose	To avoid percolation of waste (e.g., nitrate, pesticides) to groundwater and to minimize surface water overflows that have the potential to impair water quality.
Threat to Water Quality	High
Estimated Range of Costs to Comply (2013)	$0 - $1440 per farm (8 hours of consulting services @ $180/hour)
Factors Affecting Costs to Growers	Not all growers have a containment structure that receives waste. There are multiple standard practices and methods that growers can use to manage, construct, or maintain containment structures to avoid percolation of waste to groundwater and to minimize surface water overflows that have the potential to impair water quality. Many growers have already completed actions to comply with previous requirements in the 2004 Order to implement practices to protect water quality.
Cost to the public for non-compliance	Costs to municipalities, water purveyors, and homeowners to deal with polluted groundwater are in the millions of dollars over time. Contamination of groundwater is critically important to nearby residents

	who use domestic wells.

Provision 33 in the 2012 Order requires maintenance of containment structures to prevent percolation of waste to groundwater and minimize surface water overflows. The provision applies to Tier 1, 2, and 3 farms that have a containment structure (there is no requirement in the 2012 Order to build new containment structures). The maintenance of containment structures to prevent percolation of waste to groundwater and minimize surface water is a standard industry practice. This provision does not require specific actions or full implementation of improved maintenance by 2013. Nor does this provision require documentation that containment structures fully prevent percolation of waste to groundwater or minimization of surface water overflows by a specified date.

The requirement to manage containment structures appropriately and protect groundwater is not new. The 2004 Order required growers to implement management practices to protect groundwater quality and comply with water quality standards. Among other things, the 2004 Order included the following required conditions with respect to groundwater:

> *Wastewaters percolated into groundwater shall be of such quality at the point where they enter the ground so as to assure the protection of all actual or designated beneficial uses of all groundwaters of the basin.*
>
> *Wastes discharged to groundwater shall be free of toxic substances in excess of maximum contaminant levels (MCLs) for primary and secondary drinking water standards established by the United States Environmental Protection Agency or California Department of Health Services, whichever is more stringent; taste, odor, or color producing substances; and nitrogenous compounds in quantities which could result in a groundwater nitrate concentration (as NO_3) above 45 mg/l.*

Growers who complied with the 2004 Order would not need to do anything new to maintain their containment structures per the 2012 Order. By 2013, the Water Board expects growers who have containment structures to continue to implement management practices and improve them if necessary to control their discharges of waste and eventually achieve water quality standards. As part of their effective management practices growers should be evaluating the degree to which any waste will discharge to groundwater or surface water, considering factors such as depth to groundwater, what chemicals may be present in the containment structure water, what estimated volume of water is present in the structure and when, the proximity of drinking water wells, and proximity to surface water.

The cost of these actions through 2013 is estimated to range from $0 - $1440 per farm, assuming growers complied with the 2004 Order. Through the end of 2013, for growers to continue to implement existing management practices or for growers who have newly constructed containment structures who would need to initiate a qualitative evaluation of the potential for waste to discharge to groundwater or surface water, staff estimates growers may need up to 8 hours of consulting services from a qualified personnel at a rate of approximately $1800/hr. The Water Board's estimate of professional consulting services ranged from $100 to $250 per hour. $180 is the median value for this range. The cost to implement management practices or evaluate containment structures could be substantially higher if a grower took little or no action to comply with the 2004 Order. We do not speculate on or estimate costs for that scenario.

This is a standard NRCS practice[12] and the NRCS and RCDs provide information and assistance to growers on standard industry practices to construct and maintain agricultural containment structures.[13] These methods and practices include, but are not limited to the following:

- minimize volume of water in containment structure to minimize percolation;
- minimize percolation via a liner or low permeability soil floor;
- chemical treatment (e.g., enzymes);
- biological treatment (e.g., wood chips);
- contained water is recycled or reused to prevent infiltration or discharge

Issue 1C. Maintenance of riparian vegetative cover and of riparian areas (Provision 39)

Applicability	Applies to subset of Tier 1, 2 and 3 farms that are adjacent to a riparian area. (precise number of farms unknown)
Due Date	Growers are required to continue or initiate actions, but are not required to complete any specific action by 2013.
Purpose	To prevent discharge of waste by protecting existing riparian vegetation.
Threat to water quality	High
Estimated Range of Costs to Comply (2013)	$0 per farm
Factors Affecting Cost to growers	Maintaining existing vegetation does not incur any costs because compliance with this provision simply requires avoiding actions that encroach on existing, natural riparian areas and remove or impact the vegetation or streambanks. This provision does not prevent maintenance of riparian areas for flood control and other permitted purposes.
Costs to the public for not complying	Degradation of riparian habitat increases the transport of pollution, such as sediment and chemicals that adhere to sediment, and causes increasing degradation beneficial uses and loss of environmental services downstream throughout a watershed. Economic studies have estimated the value of riparian habitat and the environmental services such habitat provides in both qualitative and quantitative terms.

Provision 39 of the 2012 Order requires growers to maintain existing, naturally occurring, riparian vegetative cover (such as trees, shrubs, and grasses) in aquatic habitat areas to minimize the discharge of waste such as sediment and chemicals that adhere to sediment. This provision applies to the subset of Tier 1, 2 and 3 growers who farm adjacent to a riparian area.

By 2013, the Water Board expects growers who farm adjacent to surface waterbodies to continue to reasonably maintain existing trees, shrubs, and grasses in riparian areas to

[12] NRCS Conservation Practice Standard, Irrigation Reservoir, Code 436, May 2011. NRCS Conservation Practice Standard, Ponds, Code 378, May 2011.
[13] USDA NRCS Agricultural Handbook No. 590.1997. Ponds – Planning, Design, and Construction.

minimize the discharge of waste such as sediment and chemicals that adhere to sediment. Growers would do this by not denuding riparian vegetation or otherwise removing vegetation to the degree that it causes discharges and degradation of water quality and beneficial uses.

Cost of this action through the end of 2013 is $0 per farm (costs per acre do not apply). Maintaining existing vegetation does not incur any costs because compliance with this provision simply requires avoiding actions that encroach on existing, natural riparian areas and remove or impact the vegetation or streambanks. This condition does not require installation of any equipment, changing the area farmed, technical delineation or characterization of riparian or streambank conditions. This provision does not prohibit maintenance of riparian areas for flood control or other purposes, and does not preclude other permitted activities. This provision does not conflict with the Leafy Green Marketing Agreement, which acknowledges that growers must comply with agency requirements to protect riparian habitat.

This requirement is consistent with California Department of Fish and Game regulations and policies to protect fish, wildlife and their habitats (e.g., Fish and Game Code Section 1600-1616, 1800-1802) and with State Water Resources Control Board implementation of the Clean Water Act, Section 401 Certification regulating discharges to and filling of wetlands and the State's Wetland and Riparian Area Protection Policy.

In addition, the protection of riparian areas is a standard NRCS management practice.[14] The NRCS also provides guidance documents to help growers understand the benefits of riparian areas and standard management practices and conservation methods to protect them. The NRCS lists the multiple benefits of riparian areas, including:

- Riparian areas help control nonpoint source pollution by holding and using nutrients and reducing sediment.
- Riparian areas are often important for the recreation and scenic values. However, because riparian areas are relatively small and occur in conjunction with watercourses, they are vulnerable to severe alteration and damages caused by people.
- Riparian areas supply food, cover, and water for a large diversity of animals and serve as migration routes and stopping points between habitats for a variety of wildlife.
- Trees and grasses in riparian areas stabilize streambanks and reduce floodwater velocity, resulting in reduced downstream flood peaks.
- Alluvial aquifers help maintain the base flow in many rivers in humid areas because of high water tables. In drier climates, streams lose water that can help build up the water table deep beneath the stream.

Issue 1D. Practice Effectiveness and Compliance Reporting (Provision 44(g))

Applicability	Applies to all Tier 1, 2 and 3 farms.
Due Date	Initial Farm Water Quality Management Plan due October 1, 2012. Practice implementation is ongoing.
Purpose	To describe the methods used to verify practice effectiveness and compliance with the 2012 Order and document results in the Farm Water Quality Management Plan. The information is to inform changes to farm water quality practices and how to improve their effectiveness at

[14] NRCS Conservation Practice Standard, Riparian Forest Buffer, Code 391, July 2010.

	preventing or reducing pollution loading. This flexibility and adaptive management approach acknowledges that it will take time for practices to become effective and for growers to be able to demonstrate progress and effectiveness at reducing pollution loading through reporting.
Estimated Range of Costs to Comply (2013)	$0 – $3600 per farm (up to 20 hours of consulting services @ $180/hour)
Factors Affecting Costs to Growers	The requirement to develop and implement the Farm Water Quality Management Plan was included in the 2004 Order and is not a new requirement. Therefore, the costs to comply with similar requirements in the 2012 Order may be limited and are not necessarily “new” costs. Growers who have evaluated and adapted their Farm Plan to continue to make progress towards water quality improvement since the 2004 Order have minimal cost. Growers who did little to comply with the 2004 Order could face relatively high costs, but these are deferred costs due to non-compliance. Growers can also minimize costs through cooperative efforts, which the 2012 Order encourages.
Costs to the public for non-compliance	The degradation of water quality is well documented and severe in irrigated agriculture areas, with major economic impacts on public resources. There is no way for the Water Board or the public to determine if pollutant loading is being reduced without practice effectiveness and compliance reporting.

Provision 44(g) of the 2012 Order requires Tier 1, 2 and 3 growers to describe the methods used to verify practice effectiveness and compliance with the 2012 Order (e.g., water quality sampling, discharge characterization, reductions in pollutant loading) and document results in the Farm Water Quality Management Plan (Farm Plan). Growers are not required to use specific methods or submit the Farm Plan to the Water Board, except upon request.

The development and implementation of the Farm Plan was also a requirement of the 2004 Order[15]. The 2004 Order defined a Farm Plan as follows:

> *Farm Water Quality Management Plan (Farm Plan) - a document that contains, at a minimum, identification of practices that are currently being or will be implemented to address irrigation management, pesticide management, nutrient management and erosion control to protect water quality. Plans will contain a schedule for implementation of practices. Lists of water quality protection practices are available from several sources, including the University of California farm plan template available from the University of California.*

As part of the Farm Plan requirement in the 2004 Order, growers were required to submit a biennial management practice checklist. [16] Growers used the management practice checklist “to assess whether practices need to be adjusted or whether increased implementation is needed.”[17] Furthermore, growers were required to use the management practice checklist “to

[15] Order R3-2004-0117, Part 2A(10), 2B, 2C(b).
[16] Order R3-2004-0117, Finding 19, Part 2A(10), 2B, 2C(c).
[17] Order R3-2004-0117, Finding 19.

demonstrate that the grower was implementing the Farm Plan and that the grower has made and is implementing appropriate changes to the Farm Plan".

Therefore, the type of work required to develop and maintain a Farm Plan and effective management practices is not new. By 2013, the Water Board expects growers to continue to update their Farm Plans, including information to describe how they are evaluating whether or not their water quality management practices are working. Cost of this action through the end of 2013 is estimated to be $0 – $3600 per farm, largely depending on compliance with the 2004 Order. At the low end of the cost range, for the growers who have already initiated evaluating their Farm Plan and methods of practice of effectiveness in compliance with the 2004 Order, the costs would be none to very minimal if they chose to do this work themselves. The higher cost is based on an estimated range that it could take a grower up to 20 hours to prepare this description for their farm, and that the grower may use consulting services from qualified personnel at a rate of approximately $180/hr. Note that this is not the cost of implementing practices, but is the cost to evaluate and report effectiveness, which can be a simple observation or result. Three hours is the estimate of time to simply add existing information on practice effectiveness to the Farm Plan. Twenty hours is the estimate of time for growers who need to collect existing information, such as irrigation records, and who may need to actually collect some limited new information, like nitrate concentration in irrigation water (may purchase and use a kit to measure the water concentration), etc. Growers can reduce costs by completing this work on their own, without the services of a consultant. The costs could also be minimized through cooperative efforts, which the 2012 Order encourages. Growers who have done little or no work to comply with the 2004 Order would likely face greater costs.

As described in Finding 121 of the 2012 Order, the Farm Plan is an effective tool to identify the management practices that have been or will be implemented to protect and improve water quality. Farm Plans also contain a schedule, developed by the grower, for implementation of practices and an evaluation of progress in achieving water quality improvement.

The UCCE, NRCS, and UCANR have assisted growers for decades with tools to identify, implement and evaluate management practices. To provide growers with compliance assistance for the 2004 Order, UCANR developed Farm Water Quality Planning Short Courses and a Farm Plan template.[18] The Farm Plan template was a resource for growers to implement water quality management practices and conduct assessment and evaluation techniques. The Farm Plan template included a detailed section on self-evaluation (page 54) that instructs growers on self-evaluation techniques to determine whether water quality changes were attributed to management practice implementation. The UCANR Farm Plan template recommends simple field measurements and record keeping to evaluate practice effectiveness "inexpensively and with semi-skilled assistance" to obtain site-specific results. In 2011, the Central Coast Agricultural Water Quality Coalition developed an updated Farm Water Quality Planning template, which also included assessment and evaluation techniques to "check the success" of management practice implementation[19]. Standard recommended methods to evaluate management practice implementation include the following examples:

- Record-keeping;
- Photo-monitoring;
- Observing presence or absence of runoff;
- Evaluating amount of sediment removed from basins;

[18] Bianchi, M., D. Mountjoy, and A. Jones. 2004. Farm Water Quality Plan. UCANR Publication 8332.
[19] Central Coast Agricultural Water Quality Coalition. 2011. Farm Water Quality Planning Template.

- Effluent flow;
- Water analyses;
- Plant tissue and soil analyses;
- Recording fertilizer use;
- Utilizing crop budgets;
- Percent bare soil along stream banks;
- Percent canopy over stream

To comply with the 2004 Order, many growers have already developed a Farm Plan and implemented management practices with the assistance of UCANR and NRCS technical assistance providers. As was designed, many growers adapted the Farm Plan over time to make continuous progress towards water quality improvement and respond to changes in farm characteristics. Again, the costs to comply with Provision 44(g) in the 2012 Order may be limited and are not necessarily "new" costs. Failure to comply with the 2004 Order is not a defensible argument for "new" costs relative to the same requirement in the 2012 Order.

For growers that have not tracked and recorded information to evaluate practice effectiveness, the costs may be higher for record keeping, visual inspections, or consulting services that will inform practice effectiveness. These costs are difficult to estimate given they depend on the degree of compliance with the 2004 Order, the types and extent of water quality problems an individual farm is addressing (pesticides, nitrate and/or sediment), the numbers and types of practices being implemented at any one farm, the size of the farm, etc.

Growers can comply with this provision through visual inspection and record keeping (e.g., amount of nitrogen fertilizer applied), methods that do not require a specifically qualified or licensed professional, or use of any particular method of analysis or computer models. For example, a grower can evaluate if a change in irrigation practices was effective by visually inspecting whether there is less irrigation runoff. Growers could also keep their own records of the amount of irrigation water applied to document a reduction in the amount of water applied. Alternatively, they could hire an irrigation consultant to measure or model the actual irrigation runoff and other irrigation losses (e.g. percolation). The provision does not dictate how a grower must evaluate and report on practice effectiveness, thereby providing flexibility for growers to choose the least costly methods. For example, one grower in the Central Coast region implemented a nutrient management plan in 2011 and then reported that as a result of the nutrient management plan he reduced his fertilizer use by 50%, <u>which resulted in a significant cost savings to the grower.</u> The cost of simply reporting the result (a 50% reduction in fertilizer use) to the Water Board was not significant.

A grower may also comply using more complex or comprehensive methods, if the grower so chooses (but this provision does not require them to do so). For example, a grower can report an effective nutrient management plan by documenting his reduction in fertilizer use (as noted in the case above), and compare the amount of nitrogen applied in fertilizer and in irrigation water to the nitrogen the crop needs. This requires more effort and includes recording the amount of nitrogen in all fertilizer applications, determining amount of nitrogen in irrigation water by measuring volume of irrigation water applied and analyzing for concentration of nitrate, and measuring the amount of nitrogen in the plant. This method of evaluating effectiveness requires additional personnel hours and lab analyses for the irrigation water and the plant. A grower can also hire an agronomist or certified crop advisor or other qualified professional consultant to measure subsurface nitrogen loading by installing measuring devices at various depths in several locations on a farm several times per year based on the crop season. This last approach would clearly cost more for personnel time to design monitoring, cost of equipment and its installation, personnel time to manage data collection and evaluate data. Despite these relative increased costs, agricultural industry groups and individual growers have reported implementing these types of actions to evaluate practice effectiveness.[20] [21]

The Water Board cannot estimate the wide range of costs and level of evaluation that growers are electing to implement (ranging from complete non-compliance with the 2004 Order to comprehensive approaches beyond the requirements of the 2012 Order). The variability of farm characteristics and variety of approaches make such an estimate impossible. Furthermore, this provision does not require growers to implement a certain evaluation approach or to demonstrate that practices are fully effective in meeting certain water quality standards by 2013. This provision simply requires that an effectiveness approach be initiated in 2013. Also, the Water Board cannot estimate the level to which growers will cooperate via coalitions or other cooperative groups to lower their costs, as growers and agricultural industry representatives said they wished to do throughout the 2012 Order development process.

We realize that this flexible approach is a double-edged sword. Many growers want flexibility in how they implement practices and evaluate the results, and the 2012 Order provides this flexibility. The flexibility requires growers to evaluate how they will comply with the 2012 Order based on their specific farm characteristics and situation, which takes more time than a prescribed method. However, the flexibility of the 2012 Order has led to extreme interpretations about what is required and what the costs might be. These extreme interpretations and cost estimates are not valid in terms of what the 2012 Order actually requires, and Water Board staff has spent a great deal of time with individual growers trying to correct this misinformation.

This provision is required for consistency with the State's Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program (NPS Policy). The policy directs Water Boards to issue waste discharge requirements or conditional waivers that hold individual growers responsible for implementing and adapting management practices that effectively control nonpoint sources of pollution, such as fertilizers, pesticides and sediment in irrigated agricultural runoff. The NPS Policy specifically requires that any nonpoint source control program include "sufficient feedback mechanisms so that the Regional Water Quality Control Board, the 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." This provision is the only "feedback mechanism" that applies to Tier 1 growers. The requirement for Tier 1 and all growers to update their farm water quality plans annually to include an assessment of practice effectiveness insures "sufficient feedback mechanisms" for purposes stated in the NPS Policy. Tier 2 and Tier 3 growers must comply with additional provisions that ensure "sufficient feedback mechanisms" as discussed below.

Issue 1E. Groundwater Monitoring (Provision 51, MRPs Tiers 1-3, Part 2, Sections A & B)

Applicability	Applies to all Tier 1, 2 and 3 farms with groundwater wells. (precise number of farms unknown)

[20] Presentation by Rio Farms to the State Water Board on May 23, 2012.
[21] Presentation by the California Strawberry Commission to the Central Coast Water Board on May 4, 2011 (Slides 5-11)

Due Date	First round of sampling September – December 2012[22] Second round of sampling March – June 2013[23]
Purpose	To evaluate groundwater conditions in agricultural areas, identify areas at greatest risk for waste discharge and nitrogen loading and exceedance of drinking water standards, and identify priority areas for nutrient management.
Threat to water quality	High
Estimated Range of Costs to Comply (2013)	$0 if no groundwater wells on farm $0 if using alternative to submit existing data. $400 - $1200 per farm for Tier 1 and Tier 2 $600 - $1800 per farm for Tier 3
Factors Affecting Cost to growers	Growers must sample at least one groundwater well, if one exists on farm. Growers must sample all wells used for drinking water. The cost range is largely dependent on the number of wells to be sampled. The provision also allows Tier 1 and Tier 2 growers to submit existing data as an alternative to sampling which is little to no cost. In some cases, multiple growers share a single groundwater well and can share the cost of monitoring and reporting. Growers can also choose to conduct cooperative groundwater monitoring and reporting.
Cost to the public for non-compliance	The health threat to rural home owners with domestic wells in irrigated Ag areas is severe. Groundwater monitoring is critical to determine the extent of the problem and to identify the greatest public health risks. The health costs to the public are undocumented.

Provision 51 of the 2012 Order and MRPs Tiers 1-3, Part 2, Sections A & B require growers to conduct groundwater monitoring of specific parameters and report results for any domestic drinking water wells and the primary irrigation well at a farm, at least two times by 2013, or as an alternative growers can submit existing information that meets specified conditions in lieu of new monitoring and reporting data. This provision applies to the subset of Tier 1, 2 and 3 growers with groundwater wells. The option to submit existing information applies only to Tier 1 and Tier 2 growers.

Sampling groundwater wells for nitrate contamination is a standard industry practice recommended by the University of California Division of Agriculture and Natural Resources (UCANR) as a specific "Management Goal " identified as a "best economically achievable technology or process" for use in nutrient management[24][25] and ensuring protection of drinking water beneficial uses. Similarly, the UC Davis Report, Addressing Nitrate in California's Drinking

[22] The original due date for the first round of sampling was September – October 2012. The Executive Officer revised the Monitoring and Reporting Programs to extend the due date to December 2012 to provide additional time, flexibility and cost savings to growers.
[23] The original due date for the second round of sampling was March – April 2013. The Executive Officer revised the Monitoring and Reporting Program to extend the due date to June 2013 to provide additional time, flexibility and cost savings to growers.
[24] Pettygrove, G.S., T. Hartz, R. Smith, T. Lockhart, B. Hanson, L. Jackson, and S. Grattan. 2003. Farm Water Quality Plan Fact Sheet 3.4. Nutrient Management Goals and Management Practices for Cool-Season Vegetables. UCANR Publication 8097.
[25] NRCS Conservation Practice Standard, Well Water Testing, Code 355, September 2010.

Water[26] identifies groundwater well testing as an effective practice to address nitrate in drinking water with relatively low economic cost.

By 2013, the Water Board expects growers to sample one irrigation well and any drinking water wells on their farm (once between Sept-Dec 2012 and once between March-June 2013) and submit the results to the Water Board electronically. If growers have already done this or if there is a local study that shows groundwater is not impacted, growers with Tier 1 and Tier 2 farms can submit that information instead. Growers with Tier 3 farms may have to sample their well(s) one additional time in Sept-Dec. 2013, depending on the timing of the maximum nitrate concentration from the results of previous sampling.

The cost of these actions through the end of 2013, ranges from $0 - $1800, depending on the Tier. The range of costs depends on if the grower is submitting existing data (no collection cost), or if a grower is collecting data from one or more wells In general, the cost is $200/well. The source of the cost estimate per well is the State Water Board's Groundwater Ambient Monitoring and Assessment Program (GAMA). The Program reported a cost of approximately $190/well to sample and analyze for the parameters required by this provision. The value of $200/well was used to simplify the estimates (rounded up from $190). This cost estimate is actually higher than the prices currently being offered to growers in the Central Coast Region by various laboratories who conduct complete groundwater well water quality sampling, analysis and reporting services. The following labs are currently advertising the following costs to sample, analyze and report for one well: Fruit Grower's Lab- $160, Monterey Bay Analytical Services- $180, Oilfield Environmental and Compliance, Inc.- $180, Dellavalle Laboratory, Inc.- $155.

Finally, the provision allows growers to elect cooperative monitoring and prepare a cooperative monitoring program by March 2013, in lieu of individual well monitoring. This may significantly reduce the costs to these growers between now and December 2013, although it remains unknown if and how much growers must spend for development of the cooperative monitoring program. We cannot estimate the cost for such monitoring since the cooperative monitoring programs do not yet exist. As of August 1, 2012, 1,353 farms elected to conduct cooperative groundwater monitoring. The programs must be proposed by March 15, 2013 and the costs will depend on the numbers of growers in a group, the number of representative wells and the timing of the sampling. As an example, assume ten growers each have two wells to sample individually (20 wells), and they alternatively conduct an adequately representative cooperative monitoring program that includes only 15 wells for the area, and they do one round of sampling by December 2013, and share the cost of sampling the reduced number of wells. In this case their costs will each be $200/well for 15 wells divided amongst 10 growers for a cost of $300 each. If they each had to sample their two wells individually for two sampling events before October 1, 2013, as required by the 2012 Order, at a cost of $200/well, they would each have to spend $800. While this represents a cost savings for the actual monitoring, the cost of developing a cooperative monitoring program is unknown. In any case, growers have the option to elect cooperative or individual groundwater monitoring, as they requested.

In response to comments during the 2012 Order development process and direction from the Water Board members, staff reduced the groundwater monitoring requirements in the proposed

[26] http://groundwaternitrate.ucdavis.edu/
Harter, T. et al. UC Davis Groundwater Nitrate Project, Implementation of Senate Bill X2 1
Prepared for California State Water Resources Control Board January 2012. Addressing Nitrate in California's Drinking Water.

draft order, and the Central Coast Water Board further reduced the requirements to make the monitoring less costly at the adoption hearing. Those changes included removing the requirement to have a registered professional (e.g., geologist) collect the samples, allowing alternative information in lieu of new data, and the option to implement cooperative groundwater monitoring. Further, after adoption of the 2012 Order, the Executive Officer modified the monitoring and reporting program to extend the compliance date to elect cooperative monitoring to allow more time for growers to evaluate this option, extended the specified window of time for growers to sample from 60 days to 120 days, and removed the requirement to measure depth to groundwater. All these changes reduced costs to the grower.

This provision also provides information consistent with the NPS Policy's requirement to include "sufficient feedback mechanisms so that the Regional Water Quality Control Board, the 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."

Issue 1F. Annual Compliance Form Reporting (Provision 67, MRPs Tiers 2-3, Part 3)

Applicability	Applies to all Tier 2 and 3 farms.
Due Date	October 1, 2012 October 1, 2013 (annually thereafter)
Purpose	To evaluate and document progress towards compliance with the 2012 Order.
Estimated Range of Costs to Comply (2013)	$0 – $1440 per farm (up to 8 hours of consulting services at $180/hour)
Factors Affecting Cost	This requirement to submit an Annual Compliance Form built upon similar requirements in the previous 2004 Order. Therefore, the costs to comply with similar requirements in the 2012 Order may be limited and are not necessarily "new" costs. Growers will only incur new costs if they have done little to comply with the 2004 Order, or have newly enrolled in the 2012 Order and have not implemented actions to comply with the 2012 order. In addition, the 2012 Order requires general estimates regarding discharge characteristics and does not require specific measurements, which provides additional flexibility to growers to minimize costs.

Provision 67 requires growers with Tier 2 and Tier 3 farms to submit an Annual Compliance Form[27] electronically. The purpose of the Annual Compliance Form is to provide up-to-date information to the Central Coast Water Board to evaluate progress towards compliance with the 2012 Order, including implementation of management practices, treatment or control measures, or changes in farming practices.

Provision 67 of the 2012 Order builds upon the requirements in the previous 2004 Order to submit a farm water quality management practices checklist[28]. The purpose of the management practice checklist was to allow growers to identify management practices implemented and planned, and to assess whether practices need to be adjusted or increased based on water

[27] Draft Annual Compliance Form (August 2012)
[28] Farm Water Quality Management Practices Form (2006)

quality issues.[29] As required by the 2004 Order, approximately 1040 agricultural operations (with multiple farms) submitted a management practice checklist in January 2007.

By 2013, the Water Board expects growers with Tier 2 and Tier 3 farms to report information (general discharge characteristics and management practice information) from their Farm Plan in an Annual Compliance Form submitted to the Water Board electronically in October 2012 and October 2013. Growers would do this by answering a series of questions about their farm, using dropdown selections, and submitting the form electronically.

Cost of this action through the end of 2013 is estimated to be $0 – $1440 per farm, largely depending on how much a grower has already done to comply with the 2004 Order. At the low end of the cost range, for the growers who have knowledge and/or record keeping related to farm discharge characteristics and management practice implementation in compliance with the 2004 Order, the costs would be none to very minimal if they chose to do this work themselves. The higher cost is based on an estimated range that it will take a grower up to eight hours to gather information from their Farm Plan and fill out and submit the Annual Compliance Form. The grower or his farm employee should be able to do this at minimal cost, however the cost estimate includes costs if the grower requires the use of consulting services from qualified personnel at a rate of approximately $180/hr.

The 2012 Order requires the following type of information to be reported in the Annual Compliance Form by October 2012 and October 2013:

- Information regarding type and characteristics of discharge (e.g., estimated number of discharge points, estimated flow/volume, estimated number of tailwater days);
- Identification of any direct agricultural discharges to a stream, lake, estuary, bay, or ocean;
- Identification of specific farm water quality management practices completed, in progress, and planned to address water quality impacts;
- Nitrate concentration of irrigation water;
- Identification of the use of fertigation or chemigation and proof of proper backflow prevention devices;
- Nitrate Loading Risk factors in Table 4 or Nitrate Groundwater Pollution Hazard Index input and Nitrate Loading Risk level;
- Proof of approved California Department of Fish and Game (CDFG) Streambed Alteration Agreement, as required by CDFG for any work proposed within the bed, bank or channel of a lake or stream, including riparian areas, that has the potential to result in erosion and discharge of waste.
- A subset of Tier 2 and 3 farms that contain or are adjacent to a waterbody impaired for temperature, turbidity or sediment must also report if they have completed photo monitoring.

This type of reporting is not entirely new. The 2004 Order also required the following:

> *All applicants must submit the following information as part of their Notice of Intent (NOI) to enroll:*
>
> - *Completed application form, including location of the operation and identification of responsible parties (owners/operators)*

- *Copy of map of operation (map should be the same as the one submitted to the County Agricultural Commissioner for Pesticide Use Reporting, or equivalent)*
- *Completed management practice checklist/self assessment form*
- *Certificates of attendance at Regional Board-approved farm water quality education courses, if applicable*
- *Statement of farm water quality plan completion, if applicable*
- *Election for cooperative or individual monitoring*

The 2004 Order also included the following reporting requirements:

> *<u>Tier 1 Qualifications and Reporting Requirements</u>*
> *Tier 1 conditional waivers will be five years in length. To qualify for a Tier 1 conditional waiver, Dischargers must do the following:*
> a. *complete 15 hours of Regional Board-approved farm water quality education by the enrollment deadline*
> b. *complete a Farm Plan by the enrollment deadline*
> c. *provide a biennial practice implementation checklist to the Regional Board demonstrating that the Discharger is implementing the Farm Plan, or that the Discharger has made and is implementing appropriate changes to the Farm Plan*
> d. *perform individual water quality monitoring or participate in cooperative water quality monitoring*
>
> *<u>Tier 2 Qualifications and Reporting Requirements</u>*
> *Tier 2 conditional waivers will be one year in length, renewable up to three years. To qualify for a Tier 2 conditional waiver, operations must do the following:*
> a. *complete at least 5 hours of Regional Board-approved water quality education per year, up to a total of at least 15 hours (the first 5 hours may be completed after enrollment)*
> b. *complete a Farm Plan within three years of the enrollment deadline*
> c. *provide annual practice implementation checklists identifying currently implemented and planned management practices and progress reports on completion of requirements to the Regional Board*
> d. *perform individual water quality monitoring or participate in cooperative water quality monitoring*

This provision provides information consistent with the NPS Policy's requirement to include "sufficient feedback mechanisms so that the Regional Water Quality Control Board, the 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."

Issue 1G. Determination of Nitrate Loading Risk Factors, Determination of Total Nitrogen Applied (Provision 68, MRPs Tiers 2-3, Part 2, Section C)

Applicability	Determination of Nitrate Loading Risk applies to all Tier 2 and 3 farms. Determination of Total Nitrogen Applied applies to the subset of Tier 2 and Tier 3 farms with a HIGH Nitrate Loading Risk.

	(Precise number of farms unknown).
Due Date	Determination of Nitrate Loading Risk October 1, 2012 Determination of Total Nitrogen Applied Record keeping needed for October – December 2013
Purpose	To measure relative risk of loading nitrate to groundwater based on specific criteria: a) Nitrate Hazard Index Rating by Crop Type, b) Irrigation System Type, c) Irrigation Water Nitrate Concentration and d) Soil Type.
Estimated Range of Costs to Comply (2013)	$0 - $720 per farm. (up to 4 hours of consulting services at $180/hour)
Factors Affecting Cost	Existing tools to evaluate nitrate loading risk are readily available and easy to use. In general, growers should not have to hire consulting services to complete this task. In addition, evaluating nitrate loading risk and associated nutrient budgeting and record keeping practices are standard industry practices and many growers are already implementing these types of practices. Thus, the costs may not be "new costs" for many growers.
Costs to the public for non-compliance	The degradation of water quality is well documented and severe in irrigated agriculture areas, with major economic impacts on public resources. There is no way for the Water Board or the public to determine progress for farms with a greater risk of pollutant loading without risk analysis and compliance reporting.

Provision 68 of the 2012 Order requires Tier 2 and Tier 3 growers to evaluate the nitrate loading risk for their individual farm, using one of two specific methods: UC Water Resources Institute's Groundwater Pollution Nitrate Hazard Index or a similar method described in the 2012 ORder. Both methods measure the relative risk of loading nitrate to groundwater based on the following criteria: a) Nitrate Hazard Index Rating by Crop Type, b) Irrigation System Type, c) Irrigation Water Nitrate Concentration and d) Soil Type.

By October 1, 2012, the Water Board expects that growers with Tier 2 and Tier 3 farms will go to the UC Water Resources Institute's Online Tool to calculate their Nitrate Hazard Index for their farm. To do this, growers would answer four questions with dropdown selections about crop type, soil type, irrigation type, and deep rip. As an alternative, growers can also use an alternative method that includes irrigation water nitrate concentration, but does not include soil type.

By December 2013, the Water Board expects that growers with Tier 2 and Tier 3 farms with a resulting high nitrate loading risk will have nitrogen application records for October – December 2013. The provision does not specify how to maintain fertilizer application data, however growers may choose to record on paper, or into a standard spreadsheet or software developed by a technical service provider or the private industry. Since amount of record keeping during this time period is limited, costs are expected to be minimal.

The use of tools, such as the Groundwater Pollution Nitrate Hazard Index to evaluate nitrate loading risk and implement nutrient budgeting practices is a long-standing, standard industry practice to optimize nutrient efficiency and minimize losses. The practice to record and budget nitrogen fertilizer application is a practice widely recommended by agronomists and crop specialists such as the UCCE, UCANR, NRCS, and agricultural industry groups such as the International Plan Nutrition Institute (IPNI) and Western Plant Health Association (WPHA). Recording fertilizer inputs and evaluating potential for over fertilization and nitrogen loss is a standard industry practice recommended by the University of California Division of Agriculture and Natural Resources (UCANR) as a specific "Management Goal " and is identified as "the best economically achievable technology or process for limiting the movement of nutrients to surface water and groundwater.

The UC Davis Report, Addressing Nitrate in California's Drinking Water[30] also identifies fertilizer nitrogen record keeping as an effective practice with low economic costs. In addition, many growers already employ this and similar related practices to optimize fertilizer application and minimize losses. Furthermore, during the process to renew the 2012 Order, the "draft agriculture's alternative proposal"[31] submitted by agricultural representatives in December 2010 included the same nitrate loading risk evaluation tools as now required by the 2012 Order.

The cost of this action through the end of 2013 is estimated to be $0 - $720. The Water Board estimates that it should take approximately four hours to use the available methods to determine nitrate loading risk and maintain nitrogen application records. Since evaluating nitrate loading risk and associated nutrient budgeting and record keeping practices are standard industry practices, many growers are already implementing these types of practices. Thus, the costs are not "new costs" for growers implementing this practice to comply with the 2004 Order. In addition, existing tools to evaluate nitrate loading risk are readily available and easy to use so growers should not have to hire consulting services to complete this task and should be able to complete this task at no to minimal cost. The high end of the cost estimate takes into the account the case where a grower chooses to use of consulting services (up to four hours) from qualified personnel at a rate of approximately $180/hr. However, the 2012 Order does not require any specific qualifications to evaluate nitrate loading risk method or to determine total nitrogen applied.

These simpler loading risk methods were selected deliberately to avoid the potentially high costs of using more complex site assessments to determine loading risk or actual loading. The Central Coast Water Board also considered this risk screening to avoid establishing requirements for nutrient management practices/pollution reduction measures too broadly, such as for all Tier 2 and Tier 3 growers. With this screening, the requirements only apply to the subset of growers likely or actually discharging the highest levels of nitrate to groundwater.

This provision provides information consistent with the NPS Policy's requirement to include "sufficient feedback mechanisms so that the Regional Water Quality Control Board, the 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." Reporting total nitrogen applied specifically provides a feedback mechanism to

[30] http://groundwaternitrate.ucdavis.edu/
Harter, T. et al. UC Davis Groundwater Nitrate Project, Implementation of Senate Bill X2 1
Prepared for California State Water Resources Control Board January 2012. Addressing Nitrate in California's Drinking Water.
[31] December 3, 2010 Draft Agriculture's Alternative Proposal for the Regulation of Discharges from Irrigated Lands.

indicate reduction in loading or improved management practice in terms of nitrogen source control to protect groundwater used for drinking water from nitrate contamination.

Issue 1H: Photo Monitoring (Provision 69, MRPs Tiers 2-3, Part 4)

Applicability	Subset of Tier 2 and 3 growers with farms that contain or are adjacent to a surface waterbody impaired by sediment, turbidity or temperature (about 534 growers).
Due Date	October 1, 2012
Purpose	To document condition of streams, riparian, and wetland area habitat and the presence of bare soil within the riparian habitat area that is vulnerable to erosion; to document management practices to prevent sediment and other waste discharges directly to riparian and wetland areas
Estimated Range of Costs to Comply (2013)	$0 - $1440 per half-mile of stream per farm. (up to 8 hours of consulting services at $180/hour)
Factors Affecting Cost	Growers can likely conduct photo monitoring without hiring a professional because no special equipment, training or qualifications are necessary to take or document the photos. Costs will vary for farms with more or less than half-mile of stream per farm. Higher cost assumes that growers use the services of a qualified professional.
Costs to the public for non-compliance	The degradation of water quality is well documented and severe in irrigated agriculture areas, with major economic impacts on public resources. Agriculture near surface waterbodies can lead to removal or reduction of riparian vegetation and the impairment of its ecological functions. There is no way for the Water Board or the public to determine progress and if pollutant loading is being reduced without compliance monitoring and reporting. Economic studies have estimated the value of riparian habitat and the environmental services such habitat provides in both qualitative and quantitative terms.

Provision 67 of the 2012 Order requires a subset of Tier 2 and Tier 3 farms that contain or are adjacent to a surface waterbody impaired by sediment, turbidity or temperature (about 534 farms) to conduct photo monitoring to document condition of streams, riparian, and wetland area habitat and the presence of bare soil within the riparian habitat area that is vulnerable to erosion; and to document management practices to prevent sediment and other waste discharges directly to riparian and wetland areas

By October 1, 2012, the Water Board expects this subset of Tier 2 and Tier 3 growers to take a minimum of 5 photos (for each half mile length) to document the condition of streams, riparian, and wetland area, and any management practices implemented to prevent the discharge of waste. Growers must use protocols approved by the Executive Officer and maintain photos in the Farm Plan

The cost of actions to comply with this provision through the end of 2013 is estimated to be approximately $0 - $1440 per farm. This cost will vary for farms with more or less than half-mile of stream per farm. At the low end, growers or their farm personnel can conduct photo monitoring without assistance when conducting other routine on-farm activities. No special equipment is required other than a standard digital camera. The estimated costs are based upon growers being able to complete the photo monitoring in less than one day (8 hours). The high end of the cost estimate takes into the account the case where a grower chooses to use the consulting services of qualified personnel at a rate of approximately $180/hr. However, the 2012 Order does not require any specific qualifications to conduct photo monitoring.

This provision provides information consistent with the NPS Policy's requirement to include "sufficient feedback mechanisms so that the Regional Water Quality Control Board, the 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."

Issue 1l: Individual surface water discharge monitoring and reporting (Provision 72 and 73, MRPs Tier 3, Part 5)

Applicability	Subset of Tier 3 growers that have a surface water discharge (about 66 farms).
Due Date	Initiate sampling by October 1, 2013.
Purpose	To evaluate discharges of waste to surface water from the farms with greatest potential to impact water quality.
Estimated Range of Costs to Comply (2013)	$0 if no discharge $6,301 to $8551 per farm, if discharge to surface water.
Factors Affecting Cost	Costs depend on the size and complexity of the individual farm (e.g. number of sampling points). It is possible for the costs to exceed the range above if numerous additional sampling points are necessary. However, the 2012 Order allows the grower to propose alternative approaches or propose cooperative monitoring to significantly lower costs relative to the estimate above.
Costs to the public for non-compliance	The degradation of water quality is well documented and severe in irrigated agriculture areas, with major economic impacts on public resources. There is no way for the Water Board or the public to identify and follow-up on sources of pollution without discharge monitoring from farms using the chemicals causing the pollution. In addition, there is no way to determine progress and if pollutant loading is being reduced without compliance monitoring and reporting.

Provision 72 and 73 of the 2012 Order require Tier 3 Dischargers that have a surface water discharge to initiate individual surface water discharge monitoring by October 1, 2013.

By March 15, 2013, the Water Board expects growers with Tier 3 farms that have a discharge to a surface water body and/or an irrigation runoff containment structure to prepare a site-specific Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP), by adding site-specific information into a template prepared in advance by the Water Board.

By October 1, 2013, the Water Board expects growers with Tier 3 farms that have a discharge to surface water to initiate sampling per an approved SAP and QAPP.

The total estimated cost of the actions to comply with this provision by 2013 is estimated to be $6,301 to $8551 per farm. The total estimated cost is comprised of preparing a SAP and QAPP, plus the costs of initiating monitoring. The cost of preparing a QAPP is estimated to be $750 - $3000. This cost range assumes a ready-to-use template will be provided by the Central Coast Water Board in advance of the October 1, 2013 compliance date, which may minimize the need to hire consulting services. Growers will fill in site-specific information such as locations and numbers of sites to be sampled. Central Coast Water Board staff with expertise in designing and implementing monitoring programs (Karen Worcester, personal communication Aug. 14, 2012) estimates the time to fill in a template will be from 5 to 20 hours and the approximate cost to be $150 per hour for a qualified professional. The costs to initiate monitoring are estimated to cost $5,551. The main costs are due to the type of laboratory analysis and the number of samples required by the MRP. The $5551 amount assumes one tailwater discharge point, one stormwater discharge point, 3 sampling events: 1 without pesticides/toxicity, 2 with pesticides/toxicity. Based on Central Coast Water Board's analysis of eNOI data and individual farm characteristics (location relative to drainage area of impaired waterbodies), nearly all farms that are subject to the individual discharge monitoring requirements are less than 500 acres. Thus, the cost estimate assumes the lower frequency monitoring. However, the 2012 Order allows the grower to propose alternative approaches or propose cooperative monitoring to significantly lower costs relative to the estimate above.

These cost estimates were documented at page 34, 35, 37 and 38, Appendix F, Staff report for Board Meeting Item 14, March 2011, Central Coast Water Board. The monitoring costs have been re-estimated here to account for changes the Central Coast Water Board made when it adopted the 2012 Order.

Finally, this provision provides information consistent with the NPS Policy's requirement to include "sufficient feedback mechanisms so that the Regional Water Quality Control Board, the 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." This requirement is consistent with monitoring and reporting requirements pursuant to the California Water Code and contained in permits issued by the Regional Water Quality Control Boards for all other permitted or regulated facilities who are, or are potentially, loading pollutants to surface waters and groundwater. Such facilities include municipal and industrial wastewater treatment plants, industrial facility groundwater cleanup operations, and industrial and construction facilities with stormwater runoff.

Issue 2: Benefit to the Environment or Irrigated Lands Regulatory Program

The State Water Board instructed parties to explain the benefit to the environment or to the irrigated lands regulatory program that will accrue from compliance with the following provisions prior to the end of 2013.

Response 2:

General Statements About Benefits of Provisions Listed Below

Since the issuance of the initial 2004 Order, the Central Coast Water Board compiled substantial additional empirical data demonstrating severe groundwater and surface water pollution caused in large part by irrigated agricultural practices, including the following:

- Large-scale degradation of drinking water aquifers due to nitrate from fertilizer use, and a corresponding increasing risk to public health in areas with intensive irrigated agriculture. In some areas, the Central Coast Water Board record includes data that indicates shallow groundwater is contaminated with nitrate at concentrations up to 15 times the drinking water standard, and there are domestic wells in the area. The health threat to domestic well owners is severe.

- Widespread surface water and sediment toxicity due to pesticides.

- Widespread degradation and loss of riparian and wetland habitat.

- Widespread degradation of surface waters due to nitrate.

The data show that these problems are severe and getting worse, especially with respect to degradation of drinking water aquifers and the resulting threat to public health in rural areas. The Central Coast Water Board adopted the 2012 Order to require measurable pollutant load reductions to surface water and groundwater, while allowing growers the necessary flexibility to achieve compliance and resolve the severe water quality problems in the agricultural areas of the Central Coast Region. The requirements in the 2012 Order are scaled based on threat to water quality, as with all other Water Board programs. The majority of farmers in the Central Coast Region are in Tier 1, with the least strict requirements. The greatest amount of acreage is in Tier 2 which has requirements similar requirements as the 2004 Order plus a few additional requirements for a subset of growers.

The 2012 Order built on and improved the requirements in the 2004 Order (in direct response to input from the public and Board members at public workshops) to better protect water quality by adding monitoring and reporting of specific indicators of pollution load reduction or improved waste discharge controls. With these provisions, the Central Coast Water Board, the public and the growers will be able to track implementation effectiveness and improvement at a site level and shorter time-frames within the five-year life of the Order (e.g. annually).

As discussed previously, these provisions are required for consistency with the NPS Policy. The policy directs Water Boards to issue waste discharge requirements or conditional waivers that hold individual growers responsible for implementing and adapting management practices that effectively control nonpoint sources of pollution, such as fertilizers, pesticides and sediment in irrigated agricultural runoff. The policy specifically requires that any nonpoint source control program include “sufficient feedback mechanisms so that the Regional Water Quality Control Board, the 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.” These provisions provide the “feedback mechanisms” for purposes stated in the NPS Policy.

These provisions are also necessary to comply with the State Water Board’s Environmental Justice Goal, which is to “*Integrate Environmental Justice considerations into the development, adoption, implementation and enforcement of Board decisions, regulations and policies.”*

These provisions compel improved waste discharge control in two primary ways. First, they improve the ability and efficiency of the Central Coast Water Board to prioritize farms, geographic areas, water quality problems, and types of management practices for appropriate follow up activities to evaluate compliance and reduce discharges and protect water quality (e.g., provide technical assistance, require monitoring, conduct inspections). This is especially critical in areas where discharges affect drinking water sources and threaten public health. Targeted follow up activities will result in implementation of more effective management practices or waste discharge control, thereby reducing pollution loading and fulfilling obligation under the California Water Code to verify the adequacy and effectiveness of the Order, as it is a Waiver of Waste Discharge Requirements. Additionally, these provisions allow increased transparency because the Central Coast Water Board can evaluate the level of compliance or implementation of management practices to control waste discharges or indicators of pollution reduction and report that information to the public.

The second way these provisions compel improved waste discharge control is they provide feedback and indicators of effectiveness to the growers who are required to monitor, report and implement management practices. By adding provisions for monitoring and reporting of the highest priority pollutants, growers can better adapt and improve their implementation efforts or management practices to reduce pollution loading, specifically targeted at nitrate discharges to groundwater used for drinking water supply, and pesticides and toxicity impairing surface waters that support aquatic life.

These provisions are necessary to reduce current and on-going water quality impacts and threats to drinking water and public health from continuous and intensive fertilizer applications that leach nitrate to groundwater, to sensitive aquatic habitats in streams and estuaries from continuous and intensive discharges of pesticides causing toxicity and to streams from erosion and sediment discharges caused by on-farm soil exposure and destabilization of streambanks in riparian areas.

If the provisions are stayed, the management practices needed to be implemented to protect water quality will be delayed and the Central Coast Water Board will not get the information needed to evaluate compliance with the Basin Plan and take action to better protect water quality and beneficial uses, especially drinking water

<u>Specific Benefits for Issues Listed Below</u>

Annual Compliance Form Reporting (Provision 67, MRPs Tiers 2-3, Part 3)

Provision 67 of the 2012 Order requires growers with Tier 2 and Tier 3 farms to submit an Annual Compliance Form electronically. The very real benefit of this requirement is that it is critical to managing the Central Coast Water Board's Irrigated Lands program. The annual compliance form is a simple, straightforward mechanism that provides the Water Board staff the ability to manage the overall program. It is physically impossible to provide regulatory oversight for 4000 farming operations on an individual, as is the case with many other Water Board programs. The Water Boards increasingly use reporting mechanisms like the annual compliance form to effectively manage large numbers of dischargers (CIWQS, GeoTracker, GAMA, SWAMP, etc.). That is, the Water Boards manage databases, and use them to make critical decisions. The issue here is whether the Central Coast Water Board will have an effectively managed program or not. Without this simple tool, the program is not manageable.

The Annual Compliance Form is required for approximately 1656 farms located in close proximity to the most impaired areas of the region, producing crop types with a relatively higher risk of loading nitrate to groundwater, using chemicals known to be the source of specific toxicity in the Central Coast Region, and/or in some cases discharging pollutants directly to an impaired waterbody. The purpose of the Annual Compliance Form is for growers to provide up-to-date information to the Central Coast Water Board to evaluate and prioritize agricultural discharges based on the reporting of specific discharge characteristics, to evaluate relative threat to water quality, to evaluate status of implementation at various scales (farm scale, watershed scale, and local/regional scale) and evaluate progress towards compliance with the 2012 Order. The Annual Compliance Form information allows growers to report out on beneficial actions and positive progress towards water quality improvement. In addition, the Annual Compliance Form information allows growers and the Central Coast Water Board to identify areas and conduct follow-up where additional progress is necessary.

This provision compels implementation in two ways as discussed above. First, growers are more likely and more able to improve and demonstrate implementation based on feedback from monitoring and reporting on their activities, indicators of effectiveness, and areas for improvement. Second, the Central Coast Water Board will have more specific information to prioritize compliance assistance to target highest priority water quality problems and to characterize and report to the public on the level of implementation and water quality improvement achieved. Over time, the Central Coast Water Board will be able to better target follow up activities to result in implementation of more management practices or waste discharge control, thereby reducing pollution loading and fulfilling obligation under the California Water Code to verify the adequacy and effectiveness of the Order.

Additionally, the Central Coast Water Board will be able to use the reported information efficiently, at relatively low cost to the grower, as it will be reported to the Water Board's online GeoTracker data management system that can easily be searched, generate reports, etc. Growers can also update specific information in real-time whenever necessary without resubmitting entire documents. This will provide a significant improvement in reporting and tracking the effectiveness of individual grower compliance, as well as of the conditions of the Order and the regulatory program. The 2004 Order did not include provisions for groundwater protection, groundwater monitoring, monitoring or reporting information with which to evaluate the level of compliance or implementation of management practices to control waste discharges, or useful indicators of pollution reduction on a short-term basis. The information that will be reported annual on the compliance form will fill these gaps. Given the persistent, widespread and severe water quality problems from nitrate, pesticide and sediment discharges from irrigated agricultural runoff in the Central Coast region, the Central Coast Water Board needs this information to address the highest water quality priorities.

For example, the Annual Compliance Form enables the Water Board to identify a specific subset of farms that have an increased nitrate loading risk and are in close proximity to more vulnerable private domestic drinking water wells, and evaluate indicators of pollutant loading reduction where it is most needed. In this case, the Annual Compliance Form can provide quick answers relevant to advancing water quality protection: Do the higher nitrate loading risk farm have backflow prevention? Is the farm next to an impaired water body? Is the farm next to an impacted groundwater well or vulnerable area? What are the discharge characteristics – infrequent low volume flow or frequent high volume flow? Has the grower reduced the volume of runoff? Is the grower using nutrient budgeting? What other best management practices is the grower implementing to protect water quality? The answers to these types of questions allows the Water Board to focus follow-up in specific areas or with specific farms.

Without provisions to require growers to submit the Annual Compliance Form there are no means for growers to report progress towards water quality improvement to the Water Board.

Similarly, there is no efficient means for the Water Board to distinguish and prioritize farms based on discharge characteristics, level of threat to water quality, or status of management practice implementation and other efforts to protect water quality. Water Board staff will have to rely primarily on complaints and inspections to evaluate potential problems. Given that the Agricultural Regulatory Program regulates nearly 4000 farms and approximately 435,000 acres, relying on complaints and inspections is neither efficient nor effective given the staff resources allocated. In addition, it is also not sufficient given the severity and scale of water quality problems in agricultural areas. The Water Board must prioritize available resources toward the highest priorities. The Annual Compliance Form is a significant improvement toward implementing the regulatory program and a critical Water Board tool for efficient and effective prioritization and follow-up to maximize water quality protection and improvement.

Determination of nitrate loading risk factors, determination of total nitrogen applied (Provision 68, MRPs Tiers 2-3, Part 2, Section C)

Provision 68 of the 2012 Order requires Tier 2 and Tier 3 growers to evaluate the nitrate loading risk for their individual farm, using one of two specific methods. Nitrate loading risk is a measure of the relative risk of loading nitrate to groundwater based on the following criteria a) Nitrate Hazard Index Rating by Crop Type, b) Irrigation System Type, c) Irrigation Water Nitrate Concentration and d) Soil Type.

The nitrate loading risk factor and total nitrogen applied are two of the most important data that can be obtained. These data, reported over time, are critical to determine whether pollutant loading is decreasing. The monitoring and reporting of these data also raise awareness and change behavior.

This provision addresses the Central Coast Region's highest priority water quality problem, nitrate in drinking water that is impacting and threatening public health. The UC Davis Report, Addressing Nitrate in California's Drinking Water found that agricultural fertilizers and animal wastes applied to cropland are by far the largest regional sources of nitrate in groundwater. Furthermore, the report found that nitrogen use reporting is an important and effective tool with minimal economic cost, and also stated that future Regional Board actions to define areas at risk for nitrate contamination is essential for both safe drinking water and for addressing groundwater degradation also with minimal economic cost. The report also shows that the loading of nitrate to groundwater in our Region is double the amount that staff estimated in its report to the Central Coast Water Board. The report also documented the impacts to rural communities whose drinking water is severely impacted by the agricultural discharges of nitrate to groundwater (nitrate), Evaluating farm-level nitrate loading risk is critical in areas where drinking water is vulnerable.

Evaluating farm-level nitrate loading risk enables the quick identification of farms that have an increased threat of loading nitrate to groundwater. This allows the Central Coast Water Board to quickly screen, prioritize, and focus follow up actions (such as increased monitoring and/or reporting requirements, investigations, issuing health warnings, etc.) on a specific subset of agricultural operations – without imposing similar requirements on lower risk farms. For example, requiring growers to evaluate nitrate loading risk allows the Water Board to focus additional requirements to report total nitrogen applied on a very specific subset of farms for which such evaluations are relevant and necessary given the threat to water quality.

Nitrate loading risk serves as an important screening tool to determine which farms require more intensive and accurate loading management, evaluations and reporting. The methods required in the 2012 Order for determining nitrate loading risk are standard industry practice, and simple and inexpensive to apply. Therefore, they are beneficial as a short term investment to assess risk to insure that the Central Coast Water Board only imposes additional conditions for management practices/pollution reduction measures, and specifically reporting of total nitrogen applied, on those likely or actually discharging the greatest amounts of nitrate to groundwater and not to all growers. The Central Coast Water Board specifically identified the need to prioritize those farms most likely or actually loading nitrate to groundwater in order to most effectively protect drinking water polluted by nitrate. This is a necessary first step in reducing current and on-going water quality impacts threatening drinking water and public health from continuous and intensive fertilizer applications that leach nitrate to groundwater.

In the process to update the 2012 Order, UCCE agronomists and crop specialists have indicated to Water Board staff on numerous occasions that the single most important piece of water quality information to track is total nitrogen applied. In the absence of direct discharge monitoring to groundwater below the root-zone, it is the primary indicator of nitrate loading to groundwater. Tracking total nitrogen applied will indicate reduction in nitrogen use and nitrate loading, so the Central Coast Water Board can measure progress towards water quality improvement. This requirement will only apply to a subset of growers, those with the highest risk for loading nitrate to groundwater (see explanation of nitrate loading risk factors below). While total nitrogen applied is an indirect measure of actual nitrate leaching to groundwater, it was selected as a monitoring and reporting parameter because it is a cost-effective way to evaluate source or load reductions, compared to monitoring or using computer models to measure nitrate leaching and loading in soil and groundwater. Total nitrogen applied provides the Central Coast Water Board with information to prioritize farms, geographic areas and groundwater basins for targeted compliance assistance, additional monitoring, inspections, etc. in order to more effectively control waste discharges of nitrate to groundwater and inform water providers and the public of water quality risks to and conditions of their drinking water. Growers will be more accountable for their waste discharges and better able to adapt their management practices by monitoring and reporting this quantitative indicator of effectiveness of their nutrient management practices; this should lead to better nitrate source control and loading reductions.

Individual surface water discharge monitoring and reporting (Provisions 72 and 73, MRP Tier 3, Part 5)

Water Code section 13269 authorizes the Water Boards to conditionally waive the requirement to obtain waste discharge requirements. This section of the Water Code was significantly amended in 2000 and now specifies that any waivers in effect on January 1, 2000 will terminate by operation of law unless renewed. Renewed conditional waivers as of 2000 must be consistent with the applicable state or regional board water quality control plans and be in the public interest. The conditional waivers must also include, but are not limited to, the performance of individual, group, or watershed-based monitoring. The monitoring requirements must be designed to, among other requirements, verify the adequacy and effectiveness of the waiver's conditions. For many years the State Water Board, the Central Coast Water Board, and various entities, including agricultural dischargers, have been monitoring surface water in the Central Coast Region. This monitoring has provided significant information about the general quality of waters in the Region. However, agricultural dischargers have not been required, as are most other dischargers, to monitor individual discharges to ascertain the quality of the discharge and the impact on water quality. Now, 12 years after the significant amendments to Water Code section 13269, the 2012 Order requires very limited individual monitoring of discharges from the highest risk farms to the most impaired water bodies in the Region.

Provision 72 and 73 of the 2012 Order requires Tier 3 growers who discharge to a surface water body to initiate individual surface water discharge monitoring by October 1, 2013. This provision will benefit the environment and the regulatory program because the information will allow the Central Coast Water Board and growers to prioritize and implement actions where they are most needed. This is not a cause-and-effect monitoring program designed to determine changes in water quality based on changes in management practices, although growers can pursue that type of monitoring effort in lieu of this requirement if they wish. This sampling requirement is to determine presence and absence of critical water quality parameters such as toxicity, pesticides, and nitrate so that the Water Board and growers can prioritize and follow up on the greatest threats to public health and the environment.

The benefit to the environment and the public is the action to reduce the highest risks. Without the information, the Water Board will not identify the greatest risks and take action to reduce the risk. Monitoring, reporting, and following up on the highest risk cases is a fundamental principle of all Water Board programs.

This requirement applies to a subset of farms in Tier 3 (about 66 farms out of 110 Tier 3 farms) discharging to surface waters already impaired by nutrients, toxicity, pesticides and sediment from irrigated agricultural runoff. This provision only applies to the subset of the highest risk growers in Tier 3 that use fertilizers and pesticides most widely or intensively, are near impaired surface water or groundwater and have irrigation and stormwater runoff. The information will allow the Central Coast Water Board to (1) characterize sources of waste discharges, determine pollution load reductions, determine compliance with the conditions, and prioritize growers for follow up (e.g., inspections), and (2) verify the adequacy and effectiveness of the conditions of the 2012 Order, as required by Water Code section 13269. These actions are necessary to regulate and require water quality improvements to address the impairments from the highest priority growers, likely loading the most waste to surface waters. While the number of farms in Tier 3 is low relative to the total number enrolled, they collectively represent about 40,588 irrigated agriculture acres in the Central Coast Region and are located in the watersheds with the most severe and numerous nutrient, pesticide and sediment impairments.

As discussed above, the 2004 Order did not contain conditions or monitoring and reporting that allowed the Central Coast Water Board to conduct the above evaluations or make such determinations. These monitoring and reporting requirements improved on the 2004 Order monitoring and reporting requirements which only included cooperative surface receiving water monitoring and did not characterize waste discharges in runoff at the farm level.

The Central Coast Water Board specifically identified the need to prioritize those farms with actual or a high threat of potential discharge of pollutants to surface waters. This is a necessary first step to address the severe water quality problems in the Central Coast region and in effectively reducing current and on-going pollutant loading and associated water quality impacts impairing and threatening drinking water and public health, and sensitive organisms and habitats in riparian and estuarine areas.

Issue 3: Actions to Comply with Specific Provisions
Explain what actions the Central Coast Water Board believes are required for compliance with the following provisions prior to the end of 2013:

Response 3:

Water quality standards compliance (Provisions 22 and 23)

There is no requirement to achieve water quality standards by the end of 2013. The Time Schedule and Milestones in Table 4 of the Order require ongoing measurable progress towards water quality standards, but there is no specific deadline during that time period to show any specific amount of progress. Between now and the end of 2013, to comply with Provisions 22 and 23 of the 2012 Order, growers with Tier 1, 2, or 3 farms must develop or update their Farm Plan, continue implementing management practices identified in the Farm Plan to address site-specific water quality problems/waste discharges, continue collecting information to evaluate management practice effectiveness, and implement all provisions with specified compliance dates prior to December 2013 (such as install backflow prevention devices if they have not already done so, submit some groundwater monitoring results, submit the Annual Compliance Form reporting, Provision 67 of the 2012 Order, due in October 2012 and 2013).

The 2012 Order does not require immediate compliance with water quality standards. As stated in Finding 10 of the 2012 Order:

> "This Order requires compliance with water quality standards. Dischargers must implement, and where appropriate update or improve, management practices, which may include local or regional control or treatment practices and changes in farming practices to effectively control discharges, meet water quality standards and achieve compliance with this Order. Consistent with the Water Board's Policy on Implementation and Enforcement of the Nonpoint Source Pollution Control Program (NPS Policy, 2004), dischargers comply by implementing and improving management practices and complying with other conditions, including monitoring and reporting requirements." See Order No. R3-2012-0011, at page 4.

In other words, the Central Coast Water Board expected that growers would implement an iterative process consistent with the NPS Policy by implementing and then updating or improving management practices as needed to eventually achieve compliance with water quality standards. This approach was clarified in Attachment A to the 2012 Order, which states: "The Central Coast Water Board recognizes that growers may not achieve immediate compliance with all requirements. Thus, this Order provides reasonable schedules for growers to reach full compliance over many years by implementing management practices and monitoring and reporting programs that demonstrate and verify measurable progress annually." See Order No. R3-2012-0011 (As stated in the 2012 Order (Attachment A, Part A. AdditionalFinding #2). Table 4, Time Schedules for Milestones sets forth a milestone for Tier 1, Tier 2, and Tier 3 to achieve "measurable progress towards water quality standards in waters of the State or of the United States."

Maintenance of containment structures (Provision 33)

By 2013, to comply with Provision 33 of the 2012 Order, growers with Tier 1, 2, or 3 farms that have containment structures must continue to make reasonable progress towards implementing management practices to avoid percolation of waste to groundwater and minimize surface water overflows that have the potential to impair water quality. This was required in the 2004 Order. The 2012 Order does not require specific methods or practices. In addition, there is no specified due date for completion. It is reasonable that a grower with a lower risk discharge may take longer to initiate or complete management practice implementation. In this case, the grower would likely take minimal action by 2013. Growers can choose to implement practices such as, but not limited to, minimizing the volume of water or amount of waste in runoff to the containment structure, or implementing biological treatment using wood chips. Growers must also initiate efforts to select and implement methods to evaluate the effectiveness of chosen practices. For example, Water Board expects that growers who have new containment structures would likely do this by initiating a qualitative evaluation of what chemicals may be present in the containment structure water, what estimated volume of water is present in the structure and when, and the likelihood that any waste will discharge to groundwater or surface water considering the depth to groundwater, the proximity of drinking water wells, and proximity to surface water.

Maintenance of riparian vegetative cover and of riparian area (Provision 39)
By 2013, to comply with Provision 39, the Water Board expects growers who farm adjacent to surface waterbodies to continue to maintain existing, naturally occurring, riparian vegetative cover (such as trees, shrubs, and grasses) in riparian areas to minimize the discharge of waste such as sediment and chemicals that adhere to sediment. Growers would do this by avoiding actions that encroach on existing, natural riparian areas. Compliance with Provision 39 does not require installation of any equipment or structures, modification of the existing area farmed, or technical delineation or characterization of riparian or streambank conditions.

IV. CLOSING STATEMENT

The Central Coast Water Board will testify that the Petitioners have not met their burden of proving each of the three conditions necessary for granting a stay of conditions of the Ag Order. In particular, the Petitioners have not proved that they will suffer substantial harm while the petition is under review if a stay is not granted and they have not proved the lack of substantial harm to other interested persons and the public if a stay is granted. The request for a stay should therefore not be granted.

Stay Hearing

"Every citizen of California has the right to pure and safe drinking water."

Section 116270(a) of the California Health and Safety Code

Basis and Assumptions for Cost Estimates

- Assume growers largely complied with the 2004 Order
  - Protection of water quality
  - Farm Plans and management practices
    - Nutrient management
    - Irrigation management
    - Erosion control
    - Pesticide management
  - Effectiveness evaluations
  - Iterative improvement to achieve water quality standards over time

Basis and Assumptions for Cost Estimates

- Many costs are not new
- Management practices are not new
- Farm plans are not new
- Effectiveness evaluation is not new
- Compliance with water quality standards is not new

Basis and Assumptions for Cost Estimates

- Iterative approach over time to achieve compliance is not new
  - Immediate compliance with wq standards is not required (and not physically possible)
- Water Boards have allocated hundreds of millions in grants to Ag
- NRCS and RCDs have provided services for decades

Basis and Assumptions for Cost Estimates

- Some things are new, or partly new
  - Backflow prevention
  - Practice effectiveness reporting
  - Groundwater data reporting
  - Annual compliance form reporting
  - Nitrate loading risk and total nitrogen applied reporting
  - Photo monitoring
  - Individual surface water monitoring

Basis and Assumptions for Cost Estimates

- Non compliance with the 2004 Order is not:
  - a valid basis for claiming high costs now
  - a reason for a Stay

Issue	Provision	Estimated Cost per Farm
1a	Backflow prevention devices	$0 - $435
1b	Maintenance of containment structures	$0 - $1440
1c	Maintenance of riparian vegetative cover	$0
1d	Practice effectiveness and compliance reporting	$0 - $3600
1e	Groundwater monitoring	$0 if no groundwater wells on farm $400 - $1200 for Tier 1 and Tier 2 $600 - $1800 for Tier 3

Issue	Provision	Estimated Cost per Farm
1f	Annual compliance form reporting	\$0 – \$1440 for Tier 2 and Tier 3
1g	Determination of nitrate loading risk factors and determination of total nitrogen applied	\$0 – \$720 for Tier 2 and Tier 3
1h	Photo monitoring	\$0 - \$1440 per half-mile of stream for Tier 2 and Tier 3
1i	Individual surface water discharge monitoring and reporting	\$0 if no discharge \$6,301 to \$8551 for Tier 3 Only

Total Costs for Each Tier Through 2013 Per the Hearing Notice

- Tier 1: $0 to $6,675

- Tier 2: $0 to $10,275

- Tier 3: $0 to $19,426

Costs Can Vary Greatly

- 2012 Order Costs for 2013 can vary greatly depending on:
  - Approach used to comply (Order is highly flexible)
  - Specific management practices, expert services used
  - Cooperative versus individual effort
  - Degree of compliance with the 2004 Order
  - Work done above and beyond the 2012 Order
  - Great deal of misinformation and fear

Standards in Practice Certification

- Standards look at the farm in its entirety:
  - the worker
  - soil fertility
  - cover crops
  - wildlife
  - native plants
  - Irrigation
  - and more

Benefits of Requirements

- Annual Compliance Form
- Nitrate Loading Risk and Total Nitrogen Applied
- Individual Surface Water Monitoring

Individual Surface Water Monitoring

________________________Tier 1: 2024 farms

________________Tier 2: 1546 farms

____Tier 3: 110 Farms

__Tier 3 subset: 66 farms

Order 2012 allows alternatives

What Actions Are required to Comply?

- Water Quality Standards
  - Continue to update Farm Plan
  - Continue implementing MPs, make progress, report progress annually

What Actions Are required to Comply?

- ”The Central Coast Water Board recognizes that growers may not achieve immediate compliance with all requirements. Thus, this Order provides reasonable schedules for growers to reach full compliance over many years by implementing management practices and monitoring and reporting programs that demonstrate and verify measurable progress annually.”

What Actions Are required to Comply?

- Maintenance of Containment Structures
  - Continue to update the Farm Plan
  - Continue to implement MPs
  - Asses site specific conditions, minimize risk
  - Report progress annually

What Actions Are required to Comply?

- Maintenance of Riparian Areas
  - Maintain existing vegetation
  - Do not denude vegetation
  - Minimize degradation of vegetation
  - Allows permitted activities

Closing Statement

- 2012 Order is built on the 2004 Order
  - Many of the same basic requirements
  - Reporting is different and necessary to better inform, track, prioritize, and take action to protect water quality and public health
- Iterative costs are reasonable
- Higher costs from Petitioners may also be reasonable to protect water quality
- Criteria to grant a Stay are not met
- Note we are including the testimony and exhibits and attachments into the record.

END

Conditional Waiver of Waste Discharge Requirements
Enforcement Approach

2012 Conditional Waiver includes administrative type requirements:

Enrollment
Fees
On-line Report Submittal Due Dates

Staff can pursue enforcement for violations of these administrative requirements.

Typical Sequence:
Phone call or email
Letter to discharger
Notice of Violation
2^{nd} Notice of Violation
Propose Fine
Board Hearing

Conditional Waiver of Waste Discharge Requirements
Enforcement Approach

What about enforcement of water quality standards?

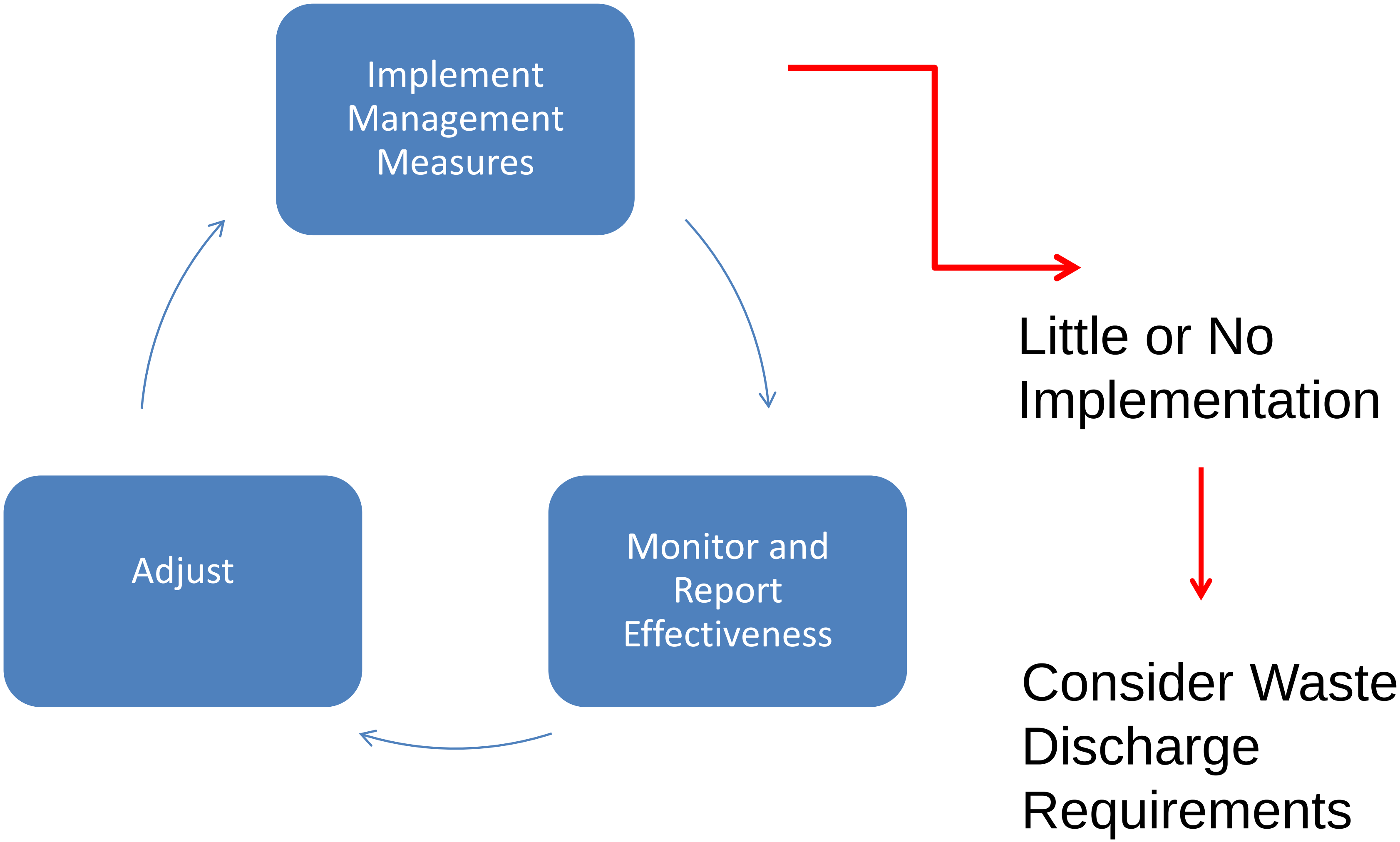
Will farmers be in violation and subject to enforcement when the Order is adopted? **No.**

Permits States (Attachment A, page 2):

The Central Coast Water Board recognizes that Dischargers may not achieve immediate compliance with all requirements. Thus, this Order provides reasonable schedules for Dischargers to reach full compliance over many years by implementing management practices and monitoring and reporting programs that demonstrate and verify measurable progress annually.

Meeting Water Quality Objectives Over Time

Iterative Process



The Best Defense is a Good Offense
Erosion Control/Vegetative Management

Standards in Practice Certification

- Standards look at the farm in its entirety:
  - the worker
  - soil fertility
  - cover crops
  - wildlife
  - native plants
  - Irrigation
  - and more

Staff Resources Dedicated

- **Lisa McCann**
- **Angela Schroeter**
- **Monica Barricarte**
- **Matt Keeling**
- **Karen Worcester**
- Shanta Keeling
- Dominic Roques
- Mary Adams
- Elaine Sahl

- John Robertson
- Harvey Packard
- Jill North
- Chris Rose
- Cecile DeMartini
- Katie DiSimone
- Hector Hernandez
- Corinne Huckaby
- Dean Thomas

- Peter Meertens
- Sorrel Marks
- Kim Sanders
- Steve Saiz
- Sheila Soderberg
- Todd Stanley
- Donette Dunaway
- John Goni
- Phil Hammer

- Mike Higgins
- Alison Jones
- Howard Kolb
- John Mijares
- Thea Tryon
- Cyndee Jones
- Gary Nichols
- Stacy Denney
- Barbara Brooks

Priorities Deferred

- **Ag Program Implementation (Compliance Eval., Assistance and Enforcement)**
- **Public Health Protection: Drinking Water**
- **Total Maximum Daily Load Orders: Address severe Ag issues**
- **Basin Plan Amendments**

The Water Board's mission is:

To preserve, enhance, and restore the quality of California's water resources… for the benefit for present and future generations.

Our Environmental Justice Policy goal is to:

Integrate Environmental Justice considerations into the development, adoption, implementation and enforcement of Board decisions, regulations and policies.

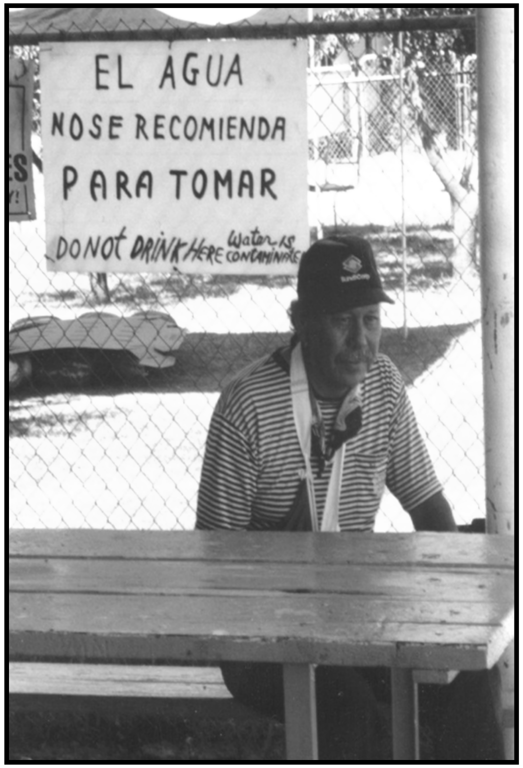
Sonia Lopez and her son Leonardo

"Our problem is going to be your problem," she said. "It's everyone's problem. There are solutions, but we need the people in charge of our communities to do something about it."

Porter Cologne says the Water Board:

…must be prepared to exercise its full power and jurisdiction to protect the quality of waters in the state from degradation…

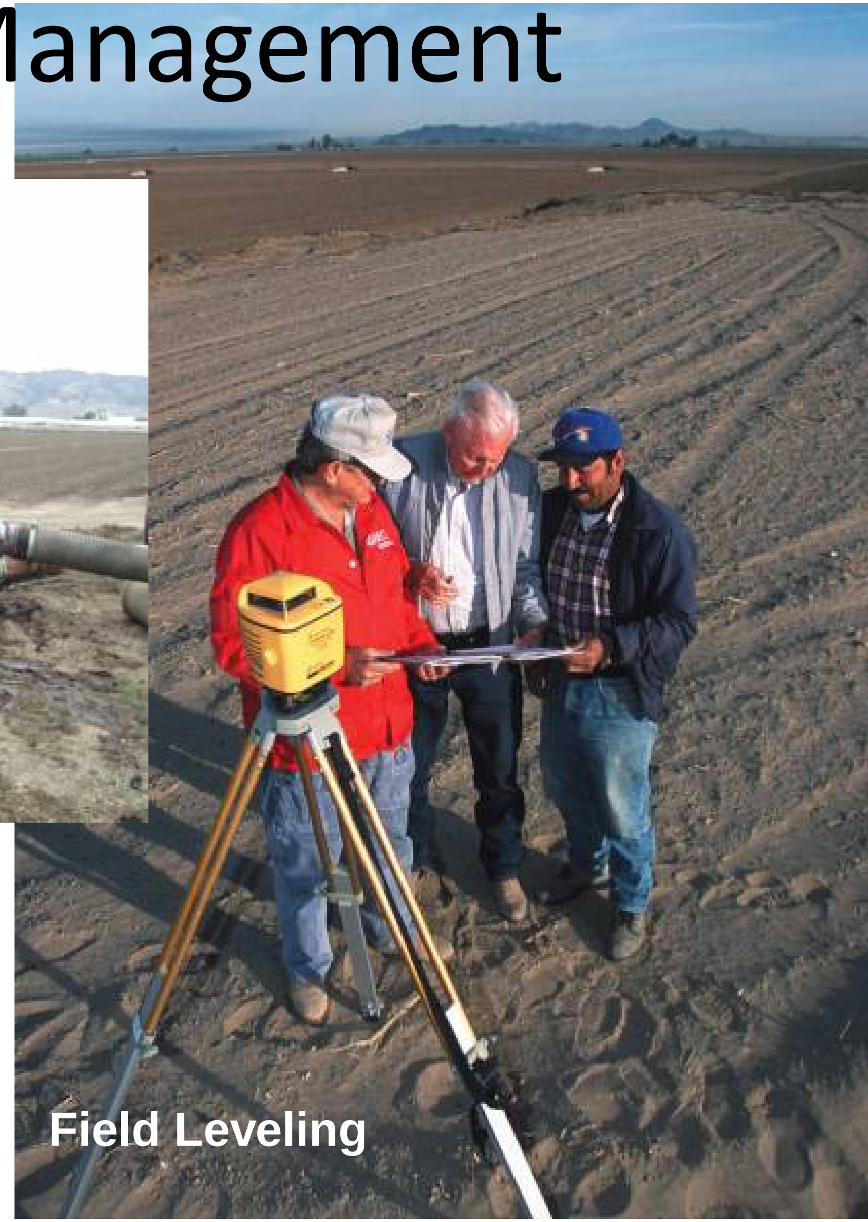
"Every citizen of California has the right to pure and safe drinking water."
Section 116270(a) of the California Health and Safety Code



Nutrient Management

Irrigation Management

Ag Mobile Lab



Field Leveling

Drip System

Pesticide Management

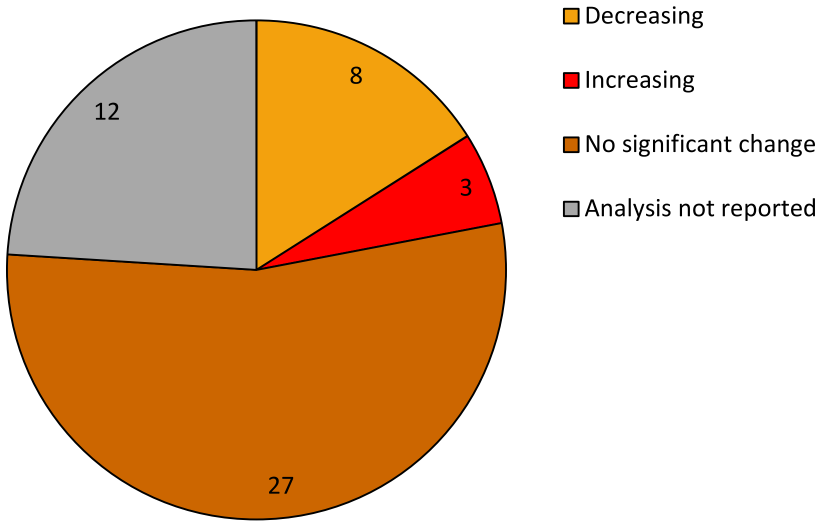
Moro Cojo Wetland Restoration

- 200 acre restoration site
- Wetlands drastically reduced exotic mouse populations
- Nearby growers are donating water to the project
- Several other local property owners interested in selling property

Moro Cojo Wetland Restoration

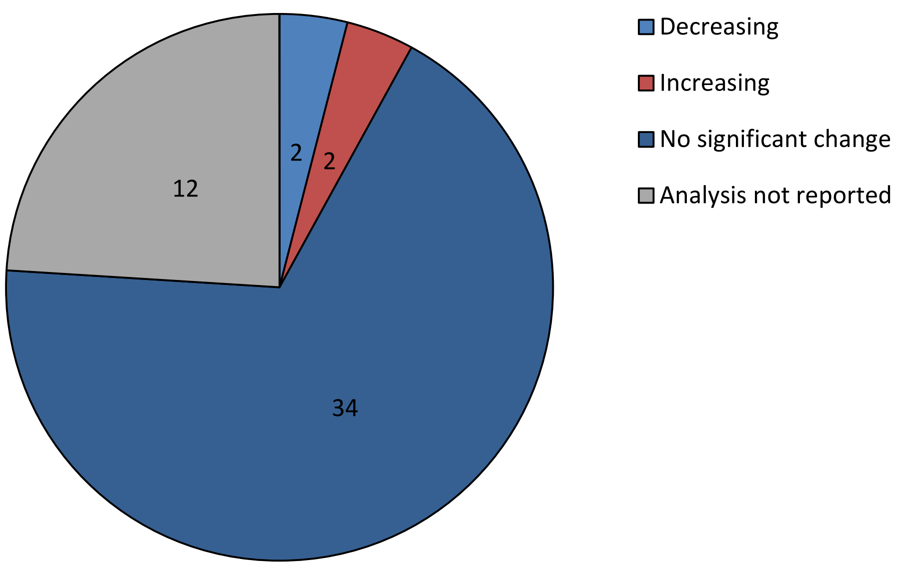
- Monitoring water quality, wildlife
- NO3 dropped from 45mg/L to 4mg/L in restored wetland

Dry Weather Nitrate Trends



Trend	Dry Weather Nitrate Trends		
Decreasing	8		
Increasing	3		
No significant change	27		
Analysis not reported	12		
	50		

Wet Weather Nitrate Trends



Trend	Wet Weather Nitrate Trends		
Decreasing	2		
Increasing	2		
No significant change	34		
Analysis not reported	12		

2004 NPS Policy:

There are many different ways for the RWQCBs to ensure compliance. In the event of noncompliance, a RWQCB could rescind a waiver, or terminate its applicability to individual dischargers, and issue WDRs in its place. If the waiver leaves significant discretion with the discharger to determine how to comply with the waiver's conditions, the RWQCB could adopt a new waiver that is more directive in terms of the actions that the dischargers must take in order to comply with the waiver. In order to be enforceable, waiver conditions should be clearly specified.

Management Measures
versus
Water Quality Objectives

Simplicity

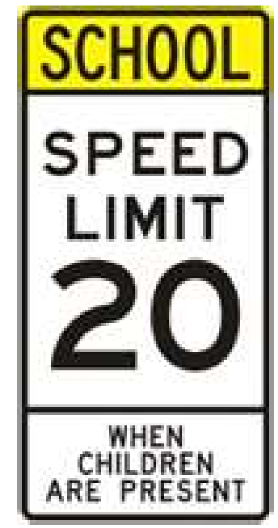
Iterative
Management
Measures…

With enforceable
requirements

Enforceable
Water Quality
Limits

Self Monitoring

When is self monitoring effective?



When there is an established limit, enforcement, and consequences.

V. EXHIBITS FOR THE RECORD

EXHIBIT IDENTIFICATION INDEX
Stay Hearing on Provisions of Order No. R3-2012-0011, Agricultural Order, and associated Monitoring and Reporting Programs, Order No. R3-2012-0011-01, -02, -03
Before the
State Water Resources Control Board
August 30, 2012

EXHIBIT NO.	DESCRIPTION
A	Summary of Testimony of Michael Thomas, Assistant Executive Officer Angela Schroeter, Senior Engineering Geologist, Agricultural Regulatory Program Manager Monica Barricarte, Water Resources Control Engineer, Agricultural Regulatory Program Staff
B	Testimony Presentation Slides
1	Order No. R3-2012-0011 (2012 Order, Conditional Waiver of Waste Discharges) and Order No.s R3-2012-0011-01, -02, -03 (Monitoring and Reporting Programs for Tiers 1, 2, 3)
2	Order No. R3-2004-0017
3	Harter, T. et al. UC Davis Groundwater Nitrate Project, Implementation of Senate Bill X2 1. Prepared for California State Water Resources Control Board January 2012. Addressing Nitrate in California's Drinking Water.
4	Staff Report to the Board, Item 14 , [Agricultural Order], March 2011
5	Appendix G, Staff Report to the Board, Item 14, [Agricultural Order], March 2011
6	Enrollment Information in the Water Board's GeoTracker data management system as of Aug. 1, 2012
7	Management Practice Implementation, Comment Letters and Hearing Testimony from growers and grower representatives, March 17, 2011
8	Central Coast Water Board. June 2007. 2006 Management Practice Checklist Summary Report.
9	Appendix F, Staff report for Board Meeting Item 14, [Agricultural Order], March 2011
10	Staff Report to the Board, Item 18, Summary of Water Board Grant Funding for Agriculture, February 2011
11	Nutrient Management Goals and Management Practices for Cool-Season Vegetables. UCANR Publication 8097.

12	USDA NRCS Agricultural Handbook No. 590.1997. Ponds – Planning, Design, and Construction.
13	USDA NRCS Conservation Practice Standard, Pond-Code 378 and Irrigation Reservoir-Code 436
14	USDA NRCS Guidance on Riparian Areas
15	Bianchi, M., D. Mountjoy, and A. Jones. 2004. Farm Water Quality Plan. UCANR Publication 8332.
16	Central Coast Agricultural Water Quality Coalition. 2011. Farm Water Quality Planning Template.
17	USDA NRCS Conservation Practice Standard, Irrigation Management-Code 449 and Nutrient Management-Code 590
18	Presentation by Rio Farms to the State Water Board on May 23, 2012.
19	Presentation by the California Strawberry Commission to the Central Coast Water Board on May 4, 2011 (Slides 5-11)
20	USDA NRCS Conservation Practice Standard, Well Water Testing, Code 355
21	Price Quotes from Laboratories for Groundwater Sampling and Analysis
22	Management Practice Checklist, Reporting Form for Order No. R3-2004-0117
23	Annual Compliance Form, Screen Shots
24	Draft Central Coast Agriculture's Alternative Proposal for the Regulation from Irrigated Agricultural Lands, CA Farm Bureau Federation, December 3, 2010
25	Nitrate Loading Risk, Nitrate Hazard Index Tool
26	Photo Monitoring Protocols
27	Photo Point Monitoring Handbook, USDA
28	Monitoring Parameters, Price Quotes for Laboratory Analysis and Cost Calculations
29	Agricultural Order, 5-Year Compliance Calendar
30	Monterey County Crop Report, 2011
31	Curricula Vitae – Michael Thomas, August 2012, Angela Schroeter, August 2012, Monica Barricarte, August 2012
32	Farm Specific Enrollment

Exhibit 1

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION

ORDER NO. R3-2012-0011

CONDITIONAL WAIVER OF WASTE DISCHARGE REQUIREMENTS
FOR
DISCHARGES FROM IRRIGATED LANDS

The California Regional Water Quality Control Board, Central Coast Region finds that:

1. The Central Coast Region has approximately 435,000 acres of irrigated land and approximately 3000 agricultural operations, which may be generating wastewater that falls into the category of discharges of waste from irrigated lands.

2. The Central Coast Region has more than 17,000 miles of surface waters (linear streams/rivers) and approximately 4000 square miles of groundwater basins that are, or may be, affected by discharges of waste from irrigated lands.

3. The State Water Resources Control Board (State Water Board) and Regional Water Quality Control Boards (Regional Water Boards) are the principal state agencies with primary responsibility for the coordination and control of water quality pursuant to the Porter-Cologne Water Quality Control Act (Porter-Cologne Act, codified in Water Code Division 7). The legislature, in the Porter-Cologne Act, directed the Water Board to exercise its full power and jurisdiction to protect the quality of the waters in the State from degradation, considering precipitation, topography, population, recreation, agriculture, industry, and economic development (Water Code § 13000).

4. On July 9, 2004, the Central Coast Regional Water Quality Control Board (Central Coast Water Board) adopted Resolution No. R3-2004-0117 establishing a Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands (2004 Agricultural Order). In the 2004 Agricultural Order, the Central Coast Water Board found that the discharge of waste from irrigated lands has impaired and polluted the waters of the State and of the United States within the Central Coast Region, has impaired the beneficial uses, and has caused nuisance. The 2004 Agricultural Order expired on July 9, 2009, and the Central Coast Water Board renewed it for a term of one year until July 10, 2010 (Order No. R3-2009-0050). On July 8, 2010, the Central Coast Water Board renewed the 2004 Agricultural Order again for an additional eight months until March 31, 2011 (Order No. R3-2010-0040).

The Central Coast Water Board did not have a quorum to take action to adopt a renewal of the 2004 Agricultural Order with modifications by the March 31, 2011 termination date. On March 29, 2011, the Executive Officer signed Executive Officer Order No. R3-2011-0208 to extend the 2004 Agricultural Order again for an additional six months, with a September 30, 2011 termination date. The Central Coast Water Board did not have a quorum to take action to adopt a renewal of the 2004 Agricultural Order with modifications by the September 30, 2011 termination date. On September 30, 2011, the Executive Officer issued Executive Officer Order No. R3-2011-0017 to extend the 2004 Agricultural Order again for an additional year, with a September 30, 2012 termination date. Executive Officer Order No. R3-2011-0017 also required dischargers to implement an updated Monitoring and Reporting Program No. R3-2011-0018. This *Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands,* Order No. R3-2012-0011 (Order) renews and revises the 2004 Agricultural Order as set forth herein.

5. Since the issuance of the 2004 Agricultural Order, the Central Coast Water Board has compiled additional and substantial empirical data demonstrating that water quality conditions in agricultural areas of the region continue to be severely impaired or polluted by waste discharges from irrigated agricultural operations and activities that impair beneficial uses, including drinking water, and impact aquatic habitat on or near irrigated agricultural operations. The most serious water quality degradation is caused by fertilizer and pesticide use, which results in runoff of chemicals from agricultural fields into surface waters and percolation into groundwater. Runoff and percolation include both irrigation water and stormwater. Every two years, the Water Board is required by Section 303(d) of the federal Clean Water Act to assess water quality data for California's waters to determine if they contain pollutants at levels that exceed protective water quality criteria and standards. This Order prioritizes conditions to control pollutant loading in areas where water quality impairment is documented in the 2010 Clean Water Act section 303(d) List of Impaired Waterbodies (hereafter referred to as 2010 List of Impaired Waterbodies). As new Clean Water Act section 303(d) Lists of Impaired Waterbodies are adopted, the Central Coast Water Board will consider such lists for inclusion in tiering criteria and conditions for this and subsequent Orders.

6. Nitrate pollution of drinking water supplies is a critical problem throughout the Central Coast Region. Studies indicate that fertilizer from irrigated agriculture is the largest primary source of nitrate pollution in drinking water wells and that significant loading of nitrate continues as a result of agricultural fertilizer practices[1]. Researchers estimate that tens of millions of pounds of nitrate leach into groundwater in the Salinas Valley alone each year. Studies indicate that irrigated agriculture contributes approximately 78 percent of the nitrate loading to

[1] Carle, S.f., B.K. Esser, J.E. Moran, High-Resolution Simulation of Basin-Scale Nitrate Transport Considering Aquifer System Heterogeneity, Geosphere, June 2006, v.2, no. 4, pg. 195-209.

groundwater in agricultural areas[2]. Hundreds of drinking water wells serving thousands of people throughout the region have nitrate levels exceeding the drinking water standard[3]. This presents a significant threat to human health as pollution gets substantially worse each year, and the actual numbers of polluted wells and people affected are unknown. Protecting public health and ensuring safe drinking water is among the highest priorities of this Order. This Order prioritizes conditions to control nitrate loading to groundwater and impacts to public water systems. In the case where further documentation indicates nitrate impacts to small water systems and/or private domestic wells, the Central Coast Water Board will consider proximity to impacted small water systems and private domestic wells for inclusion in tiering criteria.

7. Agricultural use rates of pesticides in the Central Coast Region and associated toxicity are among the highest in the State[4]. Agriculture-related toxicity studies conducted on the Central Coast since 1999 indicate that toxicity resulting from agricultural discharges of pesticides has severely impacted aquatic life in Central Coast streams[5,6,7]. Some agricultural drains have shown toxicity nearly every time the drains are sampled. Twenty-two sites in the region, 13 of which are located in the lower Salinas/Tembladero watershed area, and the remainder in the lower Santa Maria area, have been toxic in 95% (215) of the 227 samples evaluated. This Order prioritizes conditions to address pesticides that are known sources of toxicity and sources of a number of impairments on the 2010 List of Impaired Waterbodies, specifically chlorpyrifos and diazinon. In the case where further documentation indicates that additional pesticides are a primary source of toxicity and impairments in the Central Coast region, the Central Coast Water Board will consider such pesticides for inclusion in tiering criteria.

8. Existing and potential water quality impairment from agricultural waste discharges takes on added significance and urgency, given the impacts on public health, limited sources of drinking water supplies and proximity of the region's agricultural lands to critical habitat for species of concern.

[2] Monterey County Flood Control and Water Conservation District, "Report of the Ad Hoc Salinas Valley Nitrate Advisory Committee." Zidar, Snow, and Mills. November 1990.
[3] California Department of Public Health Data obtained using GeoTracker GAMA (Groundwater Ambient Monitoring and Assessment) online database, http://geotracker.waterboards.ca.gov/gama/.
[4] Starner, K., J. White, F. Spurlock and K. Kelley. Pyrethroid Insecticides in California Surface Waters and Bed Sediments: Concentrations and Estimated Toxicities. California Department of Pesticide Regulation. 2006.
[5] Anderson, B.S., J.W. Hunt, B.M. Phillips, P.A. Nicely, V. De Vlaming, V. Connor, N. Richard, R.S. Tjeerdema. Integrated assessment of the impacts of agricultural drainwater in the Salinas River (California, USA). Environmental Pollution 124, 523 - 532. 2003.
[6] Anderson B.S., B.M. Phillips, J.W. Hunt, V. Connor, N. Richard, R.S. Tjeerdema. "Identifying primary stressors impacting macroinvertebrates in the Salinas River (California, USA): Relative effects of pesticides and suspended particles" Environmental Pollution 141(3):402-408. 2006a.
[7] Anderson, B.S., B.M. Phillips, J.W. Hunt, N. Richard, V. Connor, K.R. Worcester, M.S. Adams, R.S. Tjeerdema. Evidence of pesticide impacts in the Santa Maria River Watershed (California, USA). Environmental Toxicology and Chemistry, 25(3):1160 - 1170. 2006b.

9. This Order regulates discharges of waste[8] from irrigated lands by requiring individuals subject to this Order to comply with the terms and conditions set forth herein to ensure that such discharges do not cause or contribute to the exceedance of any Regional, State, or Federal numeric or narrative water quality standard (hereafter referred to as exceedance of water quality standards) in waters of the State and of the United States.

10. This Order requires compliance with water quality standards. Dischargers must implement, and where appropriate update or improve, management practices, which may include local or regional control or treatment practices and changes in farming practices to effectively control discharges, meet water quality standards and achieve compliance with this Order. Consistent with the Water Board's Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program (NPS Policy, 2004), dischargers comply by implementing and improving management practices and complying with the other conditions, including monitoring and reporting requirements. This Order requires the discharger to address impacts to water quality by evaluating the effectiveness of management practices (e.g., waste discharge treatment and control measures), and taking action to improve management practices to reduce discharges. If the discharger fails to address impacts to water quality by taking the actions required by this Order, including evaluating the effectiveness of their management practices and improving as needed, the discharger may then be subject to progressive enforcement and possible monetary liability. The Discharger has the opportunity to present their case to the Central Coast Water Board before any monetary liability may be assessed.

11. The Central Coast Water Board encourages Dischargers to coordinate the effective implementation of cooperative water quality improvement efforts, local or regional scale water quality protection and treatment strategies (such as managed aquifer recharge projects), and cooperative monitoring and reporting efforts to lower costs, maximize effectiveness, and achieve compliance with this Order. In cases where Dischargers are participating in effective local or regional treatment strategies, and individual on-farm discharges continue to cause exceedances of water quality standards in the short term, the Executive Officer will take into consideration such participation in the local or regional treatment strategy and progress made towards compliance with water quality standards in evaluating compliance with this Order. In cases where cooperative water quality improvement efforts, or local or regional treatment strategies, coordinated by a third-party group (e.g., watershed group, water quality coalition, or other similar cooperative effort) or by a group of Dischargers, necessitate alternative water quality monitoring or a longer time

[8] This Order regulates discharge of "waste" as defined in Water Code section 13050 and "pollutants" as defined in the Clean Water Act. For simplicity, the term "waste" or "wastes" is used throughout. The term "waste" is very broad and includes "pollutants" as defined in the Clean Water Act.

schedule to achieve compliance than required by this Order, Dischargers may submit an alternative water quality monitoring and reporting plan or time schedule for approval by the Executive Officer. Groups of Dischargers and/or third party groups (e.g., a watershed group or water quality coalition) may submit to the Executive Officer for approval alternative water quality monitoring and reporting programs. An alternative monitoring and reporting program must include collection of data that will provide indicators of water quality improvement or pollution load reduction, and aggregate monitoring and reporting must be on a scale sufficient to track progress in small sub-basins and be sufficiently representative of conditions. Aggregate monitoring may apply to surface and groundwater. The Executive Officer will evaluate the alternative monitoring and reporting programs on a case-by-case basis considering the potential effectiveness of the aggregate or alternative monitoring (e.g., request to conduct aggregate monitoring for a certain timeframe to give new practices or treatment time to maximize effectiveness, and other factors such as whether the farms are currently significantly contributing to impaired surface water or ground water with drinking water wells, or whether farms are in compliance with other provisions such as enrollment, or submittal of annual compliance information). Dischargers who participate in an alternative monitoring and reporting program maintain individual responsibility to comply with this Order's conditions.

Dischargers may continue to implement alternative treatment or monitoring programs approved by the Executive Officer as long as they demonstrate continuous improvement and sufficient progress towards water quality improvement based upon measurable indicators of pollutant load reduction. Dischargers may seek review of Executive Officer decisions by the Water Board.

12. The Central Coast Water Board encourages Dischargers to coordinate the implementation of management practices with other Dischargers discharging to common tile drains, including efforts to develop regional salt and nutrient management plans. The Executive Officer may require additional monitoring and reporting for discharges to tile drains as necessary to evaluate compliance with this Order.

13. The Central Coast Water Board encourages Dischargers to participate in regional or local groundwater monitoring efforts conducted as part of existing or anticipated groundwater monitoring programs, including efforts related to regional and local salt and nutrient management plans, integrated regional water management (IRWM) plans, or the State Water Board's Groundwater Ambient Monitoring and Assessment (GAMA) Program.

14. Dischargers have the option of complying with surface receiving water quality monitoring conditions identified in MRP Order No. R3-2012-0011, either individually or through a cooperative monitoring program. The Central Coast Water Board encourages Dischargers to participate in a cooperative monitoring program to

comply with surface receiving water quality monitoring conditions. In the development of any cooperative monitoring program fee schedule, the Central Coast Water Board encourages Dischargers to scale the assessment of fees based on relative level of waste discharge and threat to water quality.

15. The Central Coast Water Board will evaluate various types of information to determine compliance with this Order such as, a) management practice implementation and effectiveness, b) treatment or control measures, c) individual discharge monitoring results, d) receiving water monitoring results, and e) related reporting.

16. Many owners and operators of irrigated lands within the Central Coast Region have taken actions to protect water quality. In compliance with the 2004 Agricultural Order, most owners and operators enrolled in the 2004 Agricultural Order, implemented the Cooperative Monitoring Program (CMP), participated in farm water quality education, developed farm water quality management plans and implemented management practices as required in the 2004 Agricultural Order. The 2004 Agricultural Order did not include conditions that allowed for determining individual compliance with water quality standards or the level of effectiveness of actions taken to protect water quality, such as individual discharge monitoring or evaluation of water quality improvements. This Order includes new or revised conditions to allow for such evaluations.

17. Water Code section 13260(a) requires that any person discharging waste or proposing to discharge waste that could affect the quality of the waters of the State, other than into a community sewer system, shall file with the appropriate Regional Board a report of waste discharge (ROWD) containing such information and data as may be required by the Central Coast Water Board, unless the Central Coast Water Board waives such requirement.

18. Water Code section 13263 requires the Central Coast Water Board to prescribe waste discharge requirements (WDRs), or waive WDRs, for the discharge. The WDRs must implement relevant water quality control plans and the Water Code.

19. Water Code section 13269(a) provides that the Central Coast Water Board may waive the requirement to obtain WDRs for a specific discharge or specific type of discharge, if the Central Coast Water Board determines that the waiver is consistent with any applicable water quality control plan and such waiver is in the public interest, provided that any such waiver of WDRs is conditional, includes monitoring conditions 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, unless waived, does not exceed five years in duration, and may be terminated at any time by the Central Coast Water Board.

20. As authorized by Water Code section 13269, this Order conditionally waives the requirement to obtain WDRs for Dischargers who comply with the terms of this Order. See Attachment A to this Order for additional findings related to legal and regulatory considerations, and rationale for this Order.

21. Pursuant to Water Code section 13267, the Executive Officer may require Dischargers to locate (inventory) and conduct monitoring of private domestic wells in or near agricultural areas with high nitrate in groundwater and submit technical reports evaluating the monitoring results. In addition, in compliance with Water Code section 13304, the Central Coast Water Board may require Dischargers to provide alternative water supplies or replacement water service, including wellhead treatment, to affected public water suppliers or private domestic well owners.

SCOPE OF ORDER NO. R3-2012-0011

Irrigated Lands and Agricultural Discharges Regulated Under this Order

22. This Order regulates (1) discharges of waste from irrigated lands, including, but not limited to, land planted to row, vineyard, field and tree crops where water is applied for producing commercial crops; (2) discharges of waste from commercial nurseries, nursery stock production, and greenhouse operations with soil floors that do not have point-source type discharges and are not currently operating under individual WDRs; and (3) discharges of waste from lands that are planted to commercial crops that are not yet marketable, such as vineyards and tree crops.

23. Discharges from irrigated lands regulated by this Order include discharges of waste to surface water and groundwater, such as irrigation return flows, tailwater, drainage water, subsurface drainage generated by irrigating crop land or by installing and operating drainage systems to lower the water table below irrigated lands (tile drains), stormwater runoff flowing from irrigated lands, stormwater runoff conveyed in channels or canals resulting from the discharge from irrigated lands, runoff resulting from frost control, and/or operational spills. These discharges can contain wastes that could affect the quality of waters of the State and impair beneficial uses.

Dischargers Regulated Under this Order

24. This Order regulates both landowners and operators of irrigated lands on or from which there are discharges of waste that could affect the quality of any surface water or groundwater (Dischargers). Dischargers are responsible for complying with the conditions of this Order. The Central Coast Water Board will hold both the landowner and the operator liable for noncompliance with this Order.

25. The Central Coast Water Board recognizes that due to different types of operations and/or locations, discharges of waste from irrigated lands may have the potential for different levels of impacts on waters of the state or of the United States. This Order establishes three tiers of regulation to take into account the variation, including different regulatory conditions for the three tiers.

26. Dischargers who have not enrolled to comply with a previous order must submit to the Central Coast Water Board a completed electronic Notice of Intent (NOI) to comply with the conditions of this Order to comply with the Water Code.

27. Dischargers who have submitted a completed electronic NOI to the Central Coast Water Board to comply with a previous order must update their NOI to reflect current operation and farm/ranch information.

28. Landowners and operators of irrigated lands who obtain a pesticide use permit from a local County Agricultural Commissioner and that have a discharge of waste that could affect surface water or groundwater, must submit to the Central Coast Water Board, a completed electronic NOI to comply with the conditions of this Order to comply with the Water Code.

29. The NOI serves as a report of waste discharge (ROWD) for the purposes of this Order.

30. The Central Coast Water Board recognizes that certain limited resource farmers (as defined by the U.S. Dept. of Agriculture) may have difficulty achieving compliance with this Order. The Central Coast Water Board will prioritize assistance for these farmers, including but not limited to technical assistance, grant opportunities, and necessary flexibility to achieve compliance with this Order (e.g., adjusted monitoring, reporting, or time schedules).

Agricultural Discharges Not Covered Under this Order and Who Must Apply for Individual Waste Discharge Requirements

31. This Order does not waive WDRs for commercial nurseries, nursery stock production and greenhouse operations that have point-source type discharges, and fully contained greenhouse operations (those that have no groundwater discharge due to impervious floors). These operations must eliminate all such discharges of wastes or submit a ROWD to apply for individual WDRs as set forth in Water Code section 13260.

PUBLIC PARTICIPATION PROCESS

32. The Central Coast Water Board notified interested persons that the Central Coast Water Board will consider the adoption of this Order, which conditionally waives individual WDRs and establishes conditions for the control of discharges of waste from irrigated lands to waters of the State, and provided several opportunities for public input.

33. In December 2008, the Central Coast Water Board invited members of the public to participate in development of this Order and provide recommendations to Central Coast Water Board staff. In particular, the Central Coast Water Board requested the assistance of an agricultural advisory panel in developing appropriate milestones, timetables, and verification monitoring programs to resolve water quality problems and achieve compliance with the Basin Plan. Additionally, in early 2009, the Central Coast Water Board notified all water purveyors, water districts and municipalities that staff was developing recommendations for this Order.

34. In December 2009, the Central Coast Water Board encouraged any interested person who wanted to present alternative recommendations to this Order to provide those recommendations in writing by April 1, 2010.

35. On February 1, 2010, the Central Coast Water Board publicly released a preliminary report and preliminary draft order for the regulation of discharges from irrigated lands and accepted comments on the preliminary draft order through June 4, 2010.

36. The Central Coast Water Board held two public workshops (May 12, 2010, and July 8, 2010) to discuss the preliminary draft order, public comments, and alternative recommendations.

37. The Central Coast Water Board released a Draft Agricultural Order and staff report on November 19, 2010, for public review and comment, and held an additional public workshop on February 3, 2011. The Central Coast Water Board released further revised versions of the Draft Agricultural Order in March, July, and August 2011 and held an additional public workshop on February 1, 2012.

38. Between November 2009 and February 2012, Central Coast Water Board staff attended more than 60 meetings and conferences to describe the process for developing the Draft Agricultural Order, discuss options, and hear public input regarding the Draft Agricultural Order. These events included numerous stakeholders representing the agricultural industry and its technical assistance providers, environmental and environmental justice organizations, local and state government agencies and other members of the public.

39. Interested persons were notified that the Central Coast Water Board will consider adoption of an Order, which conditionally waives WDRs for discharges of waste from irrigated lands, as described in this Order, and were provided an opportunity for a public hearing and an opportunity to submit written comments.

CALIFORNIA ENVIRONMENTAL QUALITY ACT

40. For purposes of adoption of this Order, the Central Coast Water Board is the lead agency pursuant to the California Environmental Quality Act (CEQA) (Pub. Res. Code §§ 21100 et seq.).

41. In 2004, the Central Coast Water Board adopted the 2004 Agricultural Order and a Negative Declaration prepared in compliance with CEQA. CEQA Guidelines state that no subsequent environmental impact report (SEIR) shall be prepared when an EIR has been certified or negative declaration adopted for a project unless the lead agency determines based on substantial evidence in light of the whole record, one or more of the following:

    (1) if substantial changes are proposed in the project which will require major revisions of the previous EIR or negative declaration due to the involvement of new significant environmental effects or a substantial increase in the severity of previously identified effects; or,

    (2) if substantial changes occur with respect to the circumstances under which the project is undertaken which will require major revisions of the previous EIR or negative declaration due to the involvement of new significant environmental impacts or a substantial increase in the severity of previously identified significant effects; or

    (3) if new information of substantial importance, which was not known and could not have been known with the exercise of reasonable diligence at the time the previous EIR was certified as complete or the negative declaration was adopted, becomes available.

    (Cal. Code Regs., tit. 14, § 15162(a).)

    This regulation applies if there is a modification of a previous project. In this case, the Central Coast Water Board is proposing to renew the 2004 Agricultural Order, which is the previous project, with clarifications and new conditions. To assist in determining whether an SEIR would be necessary, the Central Coast Water Board staff held a CEQA scoping meeting on August 16, 2010, to receive input from interested persons and public agencies on potentially significant environmental effects of the proposed project. Staff also accepted written comments regarding scoping up until August 27, 2010, in order to allow for comments from those who were unable to attend the meeting and/or for those who wished to submit additional comments. Members of the public and representatives of public agencies provided comments regarding their views on significant environmental effects associated with the adoption of a renewed Agricultural Order. As described in Findings 30 - 37 and prior to the scoping meeting in August 2010, significant public participation activities had occurred.

In preparing the Draft SEIR, Central Coast Water Board staff reviewed the 2004 Negative Declaration, including the Initial Study (Environmental Checklist), considered the comments received during the public participation process with respect to renewal of the 2004 Agricultural Order, including evidence in the record, written and oral comments, proposed alternatives, and information provided at and following the August 16, 2010 scoping meeting, and comments received on the Draft SEIR. Review of this information did not result in identification of any new environmental effects that had not already been evaluated in the 2004 Negative Declaration. Staff identified two areas included on the Environmental Checklist where there was a potential for an increase in the severity of environmental effects previously identified. These areas are (1) the potential for more severe impacts on agricultural resources due to the potential for an increase in the use of vegetated buffer strips and economic impacts due to new requirements that could take some land out of direct agricultural use and (2) the potential for more severe impacts on biological resources due to the potential for a reduction in water flows in surface waters.

The Central Coast Water Board issued a Notice of Availability on October 25, 2010, and provided the public with 45 days to submit written comments on the Draft SEIR. The Water Board received 12 written comment letters. Responses to the comments are in Section 7 of the Final SEIR. In response to comments, the Central Coast Water Board staff revised the Draft SEIR and prepared a draft Final SEIR for the Central Coast Water Board's certification. The 2004 Negative Declaration and the Final SEIR constitute the environmental analysis under CEQA for this Order.

42. With respect to Agricultural Resources, the Final SEIR concludes that adoption of the proposed alternative could result in some economic or social changes but that there was insufficient evidence to conclude that the economic changes would result in adverse physical changes to the environment. Commenters speculated that the economic impacts would be so large as to result in large scale end to agriculture and that land would be sold for other uses that would result in impacts on the environment. No significant information was provided to justify that concern. As described in Section 2.4 of this Final SEIR, the draft 2012 Agricultural Order would impose additional conditions on approximately 100 to 300 of the estimated 3000 owners or operators currently enrolled in the 2004 Agricultural Order. CEQA states that economic or social effects of a project shall not be treated as significant effects on the environment. (Pub.

Res. Code § 21083.) The Final SEIR concludes that due to some new conditions, particularly the requirement that some dischargers may be required to implement vegetated buffer strips, could result in loss of land for agricultural production since the buffer strips would generally not produce crops and some land could be converted to other uses. This impact was found to be less than significant and that mitigation could reduce impacts further. The Central Coast Water Board may not generally specify the manner of compliance and therefore, dischargers may choose among many ways to comply with the requirement to control discharges of waste to waters of the state. Even if all dischargers who could be subject to the condition to use vegetated buffers or some other method to control discharges in the draft 2012 Agricultural Order (Tier 3 dischargers) chose to use vegetated buffers or converted to other uses, the total acreage is quite small compared to the total amount of acreage used for farming and was, therefore, found to be less than significant. In addition, since the land would be used as a vegetated buffer to comply with the Order, this would result in beneficial impacts on the environment, not adverse impacts.

With respect to Biological Resources, the Final SEIR concludes that wide scale water conservation could result in lower flows into surface water resulting in impacts on aquatic life. The Central Coast Water Board may not specify the manner of compliance so it has insufficient information to evaluate the extent to which dischargers would choose to use water conservation to comply and to evaluate potential physical changes to the environment that could result. Reduction in toxic runoff may offset impacts due to the reduced flows that could occur. In addition, reduction in water use could result in increased groundwater levels that would also result in more clean water to surface water.

Based on this information, the Final SEIR concludes that the environmental effects associated with the draft 2012 Agricultural Order may be significant with respect to biological resources. However, given the uncertainty associated with evaluating the available information, it is possible that the effects may turn out to be less than significant. In Resolution R3-2012-0012, the Central Coast Water Board has made findings consistent with the CEQA Guidelines (Cal. Code Regs., tit. 14, § 15091) and a statement of overriding considerations (Cal. Code Regs., tit. 14, § 15093) with respect to biological resources.

ADDITIONAL FINDINGS

43. Attachment A to this Order, incorporated herein, includes additional findings that further describe a) the Water Board's legal and regulatory authority, b) the rationale for this Order, c) a description of the environmental and agricultural resources in the Central Coast Region, and d) impacts to water quality from agricultural discharges. Attachment A also identifies applicable plans and policies adopted by the State Water Board and the Central Coast Water Board that contain regulatory condition

that apply to the discharge of waste from irrigated lands. Attachment A also includes definitions of terms for purposes of this Order.

IT IS HEREBY ORDERED that:

1. Pursuant to Water Code sections 13260, 13263, 13267, and 13269, Dischargers must comply with the terms and conditions of this Order to meet the provisions contained in Water Code Division 7 and regulations and plans and policies adopted there under.

2. This Order shall not create a vested right to discharge, and all discharges of waste are a privilege, not a right, as provided for in Water Code section 13263(g).

3. Dischargers must not discharge any waste not specifically regulated by this Order except in compliance with the Water Code.

4. Pursuant to Water Code section 13269, the Central Coast Water Board waives the requirement that Dischargers obtain WDRs pursuant to Water Code section 13263(a) for discharges of waste from irrigated lands, if the Discharger enrolls in and complies with this Order, including Attachments and Monitoring and Reporting Program (MRP) Order No. R3-2012-0011.

5. Pursuant to Water Code section 13269, this action waiving the issuance of WDRs for certain specific types of discharges: 1) is conditional; 2) may be terminated by the Central Coast Water Board at any time; 3) may be superseded if the State Water Board or Central Coast Water Board adopts specific WDRs or general WDRs for this type of discharge or any individual discharger; 4) does not permit any illegal activity; 5) does not preclude the need for permits which may be required by other local or governmental agencies; 6) does not preclude the Central Coast Water Board from requiring WDRs for any individual discharger or from administering enforcement remedies (including civil liability) pursuant to the Water Code; and 7) includes conditions for the performance of individual, group, and watershed-based monitoring in the form of monitoring requirements 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.

6. Dischargers or groups of Dischargers seeking regulatory requirements tailored to their specific operation, farm/ranch, geographic area, or commodity may submit an ROWD to obtain individual or general orders for a specific discharge or type of discharge (e.g., commodity-specific general order). This Order remains applicable until such individual or general orders are adopted by the Central Coast Water Board.

7. The Executive Officer may propose, and the Water Board may adopt, individual WDRs for any Discharger at any time.

8. The Central Coast Water Board or the Executive Officer may, at any time, terminate applicability of this Order with respect to an individual Discharger upon written notice to the Discharger.

9. Dischargers are defined in this Order as both the landowner and operator of irrigated cropland, and both must comply with this Order.

10. Dischargers may comply with this Order by participating in third-party groups (e.g., watershed group, or water quality coalition, or other similar cooperative effort) approved by the Executive Officer or Central Coast Water Board. In this case, the third-party group will assist individual growers in achieving compliance with this Order, including implementing water quality improvement projects and required monitoring and reporting programs as described in MRP Order No. R3-2012-0011-01, MRP Order No. R3-2012-0011-02, and MRP Order No. R3-2012-0011-03, or alternative monitoring and reporting programs as provided in Condition 11 below. Consistent with the Water Board's Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program (NPS Policy, 2004), the ineffectiveness of a third-party group through which a Discharger participates in nonpoint source control efforts cannot be used as an excuse for lack of individual discharger compliance. Individual Dischargers continue to be responsible for complying with this Order.

11. Dischargers may form third party groups to develop and implement alternative water quality management practices (i.e., group projects) or cooperative monitoring and reporting programs to comply with this Order. At the discretion of the Executive Officer, Dischargers that are a participant in a third party group that implements Executive Officer-approved water quality improvement projects or Executive Officer-approved alternative monitoring and reporting programs may be moved to a lower Tier (e.g., Tier 3 to Tier 2, Tier 2 to Tier 1) and/or provided alternative project-specific timelines, and milestones.

    To be subject to Tier changes or alternative timelines, Projects will be evaluated for, among other elements:

    - Project Description. Description must include identification of participants, methods, and time schedule for implementation.
    - Purpose. Proposal must state desired outcomes or goals of the project (e.g., pollutants to be addressed, amount of pollution load to be reduced, water quality improvement expected).
    - Scale. Solutions must be scaled to address impairment.

- Chance of Success. Projects must demonstrate a reasonable chance of eliminating toxicity within the permit term (five years) or reducing discharge of nutrients to surface and groundwater.
- Long term solutions and contingencies. Proposals must address what new actions will be taken if the project does not meet goals and how the project will be sustained through time.
- Accountability. Proposals must set milestones that indicate progress towards goals stated as above in "purpose."
- Monitoring and reporting. Description of monitoring and measuring methods, and information to be provided to the Water Board. Monitoring points must be representative but may not always be at the edge-of-farm so long as monitoring results demonstrate water quality improvement and the efficacy of a project. In addition, monitoring must 1) characterize and be representative of discharge to receiving water, 2) demonstrate project effectiveness, 3) and verify progress towards water quality improvement and pollutant load reduction,

Project proposals will be evaluated by a Technical Advisory Committee (TAC) comprised of: Two researchers or academics skilled in agricultural practices and/or water quality, one farm advisor (e.g., from Natural Resources Conservation Service or local Resource Conservation Districts), one grower representative, one environmental representative, one environmental justice or environmental health representative, and one Regional Board staff. The TAC must have a minimum of five members to evaluate project proposals and make recommendations to the Executive Officer. The Executive Officer has discretion to approve any project after receiving project evaluation results and recommendations from the committee. If the Executive Officer denies approval, the third party group may seek review by the Regional Board. As stated in the NPS Policy, management practice implementation is not a substitute for compliance with water quality requirements. If the project is not effective in achieving water quality standards, additional management practices by individual Dischargers or the third party group will be necessary.

12. Dischargers who are subject to this Order shall implement management practices, as necessary, to improve and protect water quality and to achieve compliance with applicable water quality standards.

Part A. Tiers

13. Dischargers are classified into a tier based upon criteria that define the risk to water quality and the level of waste discharge. The Central Coast Water Board may update the criteria, as necessary.

14. Dischargers must determine the tier that applies to the individual farm(s)/ranch(es) at their operation or lands when they enroll or update their Notice of Intent (NOI), via electronic submittal. See Part D. Submittal of Technical Reports.

15. **<u>Tier 1</u>** – Applies to all Dischargers whose individual farm/ranch meets all of the criteria described in **(1a), (1b), and (1c)**, or whose individual farm/ranch is certified in a sustainable agriculture program identified in **(1d)** that requires and verifies effective implementation of management practices that protect water quality:

    1a. Discharger does not use chlorpyrifos or diazinon at the farm/ranch, which are documented to cause toxicity in surface waters in the Central Coast Region;

    1b. Farm/ranch is located more than 1000 feet from a surface waterbody listed for toxicity, pesticides, nutrients, turbidity or sediment on the 2010 List of Impaired Waterbodies[9] (Table 1);

    1c. If the Discharger grows crop types with high potential to discharge nitrogen to groundwater (as defined in Attachment A) at the farm/ranch, and the farm/ranch total irrigated acreage is *less than* 50 acres, and is *not* within 1000 feet of a well that is part of a public water system (as defined by the California Health and Safety Code, section 116275) that exceeds the maximum contaminant level (MCL) for nitrate, nitrite, or nitrate + nitrite[10];

    1d. Sustainability in Practice (SIP, certified by the Central Coast Vineyard Team) or other certified programs approved by the Executive Officer.

[9] The 2010 List of Impaired Waterbodies is available on the Water Board's Impaired Water Bodies website at http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml.

[10] California Department of Health Services (CDPH) has determined that public water system well location records are confidential and exempt from disclosure to the public. Until such time that public water system well location records become available to the public, the Central Coast Water Board will identify Dischargers who are within 1000 feet of a public water system well that exceeds the maximum contaminant level (MCL) for nitrate, nitrite, or nitrate + nitrite. Dischargers should evaluate their tier for the purposes of this Order based on all information available. In the case where a Discharger should be placed into a different tier based on proximity to a public water system well, the Central Coast Water Board will provide appropriate notice to the Discharger. Approximate locations for public water system wells are available on the Water Board's GeoTracker GAMA website at http://geotracker.waterboards.ca.gov/gama/.

16. **Tier 2** – Applies to all Dischargers whose individual farm/ranch does not meet the Tier 1 or Tier 3 criteria. In general, a Tier 2 Discharger's farm/ranch meets at least one of the characteristics described in **(2a), (2b), or (2c)**:

    2a. Discharger applies chlorpyrifos or diazinon at the farm/ranch, which are documented to cause toxicity in surface waters in the Central Coast Region;

    2b. Farm/ranch is located within 1000 feet of a surface waterbody listed for toxicity, pesticides, nutrients, turbidity or sediment on the 2010 List of Impaired Waterbodies[9] (see Table 1);

    2c. Discharger grows crop types with high potential to discharge nitrogen to groundwater (as defined in Attachment A) at the farm/ranch, and the farm/ranch total irrigated acreage is greater or equal to 50 acres and *less than* 500 acres, or the farm/ranch is *within* 1000 feet of a well that is part of a public water system (as defined by the California Health and Safety Code, section 116275) that exceeds the maximum contaminant level (MCL) for nitrate, nitrite, or nitrate + nitrite[10];

17. **Tier 3** – Applies to all Dischargers whose individual farm/ranch meets one of the following sets of criteria ***(3a) or (3b)***:

    3a. Discharger grows crop types with high potential to discharge nitrogen to groundwater (as defined in Attachment A) at the farm/ranch, and farm/ranch total irrigated acreage is *greater than or equal* to 500 acres;

    3b. Discharger applies chlorpyrifos or diazinon at the farm/ranch, and the farm/ranch discharges irrigation or stormwater runoff to a waterbody listed for toxicity or pesticides on the 2010 List of Impaired Waterbodies[9] (Table 1);

18. Dischargers may submit a request to the Executive Officer to approve transfer to a lower tier. The Discharger must provide information to demonstrate a lower level of waste discharge and a lower threat to water quality, including site-specific operational and water quality information to characterize the waste discharge and resulting effect on water quality. Dischargers remain in the tier determined by the criteria above and must meet all conditions for that tier until the Executive Officer approves the request to transfer to a lower tier. At a minimum, information provided by Dischargers requesting transfer to a lower tier must include the following:
    a. Farm/ranch maps(s) identifying discharge points and any water quality sampling locations;

b. Schematic showing the flow of irrigation and stormwater runoff, including where it leaves the farm/ranch and where the discharge enters receiving water;
c. Description of the volume of discharges and when the discharge is present;
d. Description of type of chemicals applied (e.g., pesticide and fertilizer use);
e. Description of estimated pollutant loading to groundwater;
f. Description and results of any individual discharge water quality sampling information available (e.g., irrigation runoff and stormwater sampling, lysimeter sampling);

19. The Executive Officer may elevate Tier 1 or Tier 2 Dischargers to a higher tier if the Discharger poses a higher threat to water quality based on information submitted as part of the NOI, MRP, or information observed upon inspection of a ranch/farm, or any other appropriate evidence that indicates the ranch/farm meets the criteria for a higher tier.

20. The Executive Officer may require Dischargers to enroll irrigated land with similar characteristics (e.g., same landowner or operator), and proximal, adjacent, or contiguous location, as a single operation or farm/ranch.

21. Unless otherwise specified, the conditions of this Order apply to all Dischargers, including Tier 1, Tier 2, and Tier 3.

Part B. General Conditions and Provisions for All Dischargers - Tier 1, Tier 2, and Tier 3

Water Quality Standards-

22. Dischargers must comply with applicable water quality standards, as defined in Attachment A, protect the beneficial uses of waters of the State and prevent nuisance as defined in Water Code section 13050.

23. Dischargers must comply with applicable provisions of the Central Coast Region Water Quality Control Plan (Basin Plan) and all other applicable water quality control plans as identified in Attachment A.

24. Dischargers must comply with applicable Total Maximum Daily Loads (TMDLs), including any plan of implementation for the TMDL, commencing with the effective date or other date for compliance stated in the TMDL. A list of TMDLs adopted by the Central Coast Water Board is available on the Central Coast Water Board website at: http://www.waterboards.ca.gov/centralcoast/water_issues/programs/ tmdl/index.shtml.

25. Discharges shall not discharge any waste not specifically regulated by the Order described herein, unless the Discharger complies with Water Code section 13260(a) by submitting a ROWD and the Central Coast Water Board either issues WDRs pursuant to Water Code section 13263 or an individual waiver pursuant to Water Code section 13269, or the conditions specified in Water Code section 13264(a) must be met by the Discharger. Waste specifically qualifying for conditional discharge under this Waiver includes earthen materials, including soil, silt, sand clay, rock: inorganic materials (such as metals, salts boron, selenium, potassium, nitrogen, etc.); organic materials; and pesticides that may enter or threaten to enter into waters of the state. Examples of wastes not qualifying for conditional discharge under this Order include hazardous waste and human waste.

26. Dischargers shall not discharge any waste at a location or in a manner different from that described in the NOI.

27. Dischargers shall not discharge chemicals such as fertilizers, fumigants or pesticides down a groundwater well casing.

28. Dischargers shall not discharge chemicals used to control wildlife (such as bait traps or poison) directly into surface waters, or place the chemicals in a location where they may be discharged to surface waters.

29. Dischargers shall not discharge agricultural rubbish, refuse, irrigation tubing or tape, or other solid wastes into surface waters, or place such materials where they may contact or may eventually be discharged to surface waters.

30. This Order does not authorize persons to discharge pollutants from point sources to waters of the United States, including wetlands, where the Discharger is required to obtain an NPDES permit under Clean Water Act section 402 (NPDES), or a dredge and fill permit under Clean Water Act section 404 (dredge and fill), except as authorized by an NPDES permit or section 404 permit. An area is considered a wetland, subject to Clean Water Act section 404, if it meets the United States Army Corps of Engineers’ definition as described in the Code of Federal Regulations and associated wetland delineation procedures, or relevant Water Board definitions.

Waste Discharge Control-

31. **By October 1, 2012**, Dischargers that apply fertilizers, pesticides, fumigants or other chemicals through an irrigation system must have functional and properly maintained back flow prevention devices installed at the well or pump to prevent pollution of groundwater or surface water, consistent with any applicable DPR requirements or local ordinances. Back flow prevention devices used to protect

water quality must be those approved by USEPA, DPR, CDPH, or the local public health or water agency.

32. **By October 1, 2015,** Dischargers must properly destroy all abandoned groundwater wells, exploration holes or test holes, as defined by Department of Water Resources (DWR) Bulletin 74-81 and revised in 1988, in such a manner that they will not produce water or act as a conduit for mixing or otherwise transfer groundwater or waste constituents between permeable zones or aquifers. Proper well abandonment must be consistent with any applicable DWR requirements or local ordinances.

33. Dischargers who utilize containment structures (such as retention ponds or reservoirs) to achieve treatment or control of the discharge of wastes must manage, construct, or maintain such containment structures to avoid percolation of waste to groundwater that causes or contributes to exceedances of water quality standards, and to minimize surface water overflows that have the potential to impair water quality.

34. Dischargers must implement proper handling, storage, disposal and management of pesticides, fertilizer, and other chemicals to prevent or control the discharge of waste to waters of the State that causes or contributes to exceedances of water quality standards.

35. Upon request, Dischargers must submit information regarding compliance with any Department of Pesticide Regulation (DPR) adopted or approved surface water or groundwater protection requirements.

36. Dischargers must implement water quality protective management practices (e.g., source control or treatment) to prevent erosion, reduce stormwater runoff quantity and velocity, and hold fine particles in place.

37. Dischargers must minimize the presence of bare soil vulnerable to erosion and soil runoff to surface waters and implement erosion control, sediment, and stormwater management practices in non-cropped areas, such as unpaved roads and other heavy use areas.

38. Dischargers must comply with any applicable stormwater permit.

39. Dischargers must a) maintain existing, naturally occurring, riparian vegetative cover (such as trees, shrubs, and grasses) in aquatic habitat areas as necessary to minimize the discharge of waste; and b) maintain riparian areas for effective streambank stabilization and erosion control, stream shading and temperature control, sediment and chemical filtration, aquatic life support, and wildlife support to minimize the discharge of waste;

40. In the case where disturbance of aquatic habitat is necessary for the purposes of water quality improvement, restoration activities, or other permitted activities, Dischargers must implement appropriate and practicable measures to avoid, minimize, and mitigate erosion and discharges of waste, including impacts to aquatic habitat.

41. Upon request, where required by California Fish and Game Code, Dischargers must submit proof of an approved Streambed Alteration Agreement from the California Department of Fish and Game (CDFG) for any work conducted within the bed, bank or channel of a lake or stream, including riparian areas, that has the potential to result in erosion and discharges of waste to waters of the State.

42. Upon request, where required by California Forest Practice Rules, Dischargers must submit proof of California Department of Forestry and Fire Protection authorization, and enrollment in the Central Coast Water Board's General Conditional Waiver of WDRs – Timber Harvest Activities in the Central Coast Region, for any commercial harvesting of timber that has the potential to result in erosion and discharges of waste to waters of the State.

43. Upon request, where required by Clean Water Act Section 404, Dischargers must submit proof of a dredge and fill permit from the United States Army Corps of Engineers (USACOE) for any work that has the potential to discharge wastes considered "fill," such as sediment, to wetlands.

44. **By October 1, 2012**, Dischargers must develop a farm water quality management plan (Farm Plan), or update the Farm Plan as necessary, and implement it to achieve compliance with this Order. Farm Plans must be kept current, kept on the farm, and a current copy must be made available to Central Coast Water Board staff, upon request. At a minimum, Farm Plans must include:

    a. Copy of this Order and a copy of the Notice of Intent (NOI) submitted to the Central Coast Water Board for reference by operating personnel and inspection by Central Coast Water Board staff;
    b. Date the Farm Plan was last updated;
    c. Farm/ranch maps(s) identifying irrigation and stormwater runoff discharge locations where irrigation and stormwater runoff leaves or may leave the farm/ranch and where the discharge enters or may enter receiving water;
    d. Description of the typical volume of discharges and when the discharge is typically present;
    e. Description of type of chemicals applied (e.g., pesticide and fertilizer use);
    f. Description and time schedule for any farm water quality management practices, treatment and/or control measures implemented to comply with this Order. This includes, but is not limited to, management practices

related to irrigation efficiency and management, pesticide management, nutrient management, salinity management, sediment and erosion control (including stormwater management), and aquatic habitat protection to achieve compliance with this Order. In addition, Farm Plans must describe tile drain discharges and the management measures Dischargers have implemented or will implement to minimize impacts to water quality;

g. Description and results of methods used to verify practice effectiveness and compliance with this Order (e.g., water quality sampling, discharge characterization, reductions in pollutant loading);

45. Dischargers must obtain appropriate farm water quality education and technical assistance necessary to achieve compliance with this Order. Education should focus on meeting water quality standards by identifying on-farm water quality problems, implementing pollution prevention strategies and implementing practices designed to protect water quality and resolve water quality problems to achieve compliance with this Order.

Other Provisions and Conditions-

46. Pursuant to Water Code section 13267(c), the Central Coast Water Board staff or its authorized representatives may investigate the property of persons subject to this Order to ascertain whether the purposes of the Porter-Cologne Act are being met and whether the Discharger is complying with the conditions of this Order. The inspection shall be made with the consent of the owner or possessor of the facilities, or if consent is withheld, with a duly issued warrant pursuant to the procedure set forth in Title 13 Code of Civil Procedure Part 3 (commencing with Section 1822.50). However, in the event of an emergency affecting the public health or safety, an inspection may be performed without consent or the issuance of a warrant.

47. This Order does not authorize any act that results in the taking of a threatened or endangered species or any act that is now prohibited, or becomes prohibited in the future, under either the California Endangered Species Act (Fish and Game Code Sections 2050 to 2097) or the federal Endangered Species Act (16 U.S.C.A. Sections 1531 to 1544). If a "take" will result from any act authorized under this Order, the Dischargers must obtain authorization for an incidental take prior to taking action. Dischargers must be responsible for meeting all requirements of the applicable Endangered Species Act for the discharge authorized by this Order.

48. Dischargers must pay a fee to the State Water Resources Control Board in compliance with the fee schedule contained in Title 23 California Code of Regulations.

49. Dischargers must pay any relevant monitoring fees (e.g., Cooperative Monitoring Program) necessary to comply with monitoring and reporting conditions of this Order or comply with monitoring and reporting requirements individually.

Part C. Monitoring Conditions for All Dischargers- Tier 1, Tier 2, and Tier 3

50. Dischargers must comply with MRP Order No. R3-2012-0011, as ordered by the Executive Officer or alternative monitoring and reporting programs approved by Executive Officer as set forth in Finding 11 and Condition 11.

    Monitoring and reporting conditions are different for each tier, based on level of waste discharge and affect on water quality. Attached to this Order are three specific MRPs, one for each tier:

    a. Tier 1 Dischargers must comply with monitoring and reporting conditions specified in MRP Order No. R3-2012-0011-01;
    b. Tier 2 Dischargers must comply with monitoring and reporting conditions specified in MRP Order No. R3-2012-0011-02;
    c. Tier 3 Dischargers must comply with monitoring and reporting conditions specified in MRP Order No. R3-2012-0011-03;

51. Tier 1, Tier 2, and Tier 3 Dischargers must conduct groundwater monitoring and reporting in compliance with MRP Order No. R3-2012-0011-01, MRP Order No. R3-2012-0011-02, and MRP Order No. 2012-0011-03, or alternative monitoring and reporting programs approved by Executive Officer as set forth in Finding 11 and Condition 11, so that the Central Coast Water Board can evaluate groundwater conditions in agricultural areas, identify areas at greatest risk for waste discharge and nitrogen loading and exceedance of drinking water standards, and identify priority areas for nutrient management.

52. Tier 1, Tier 2, and Tier 3 Dischargers must conduct surface receiving water quality monitoring and reporting in compliance with MRP Order No. R3-2012-0011-01, MRP Order No. R3-2012-0011-02, and MRP Order No. 2012-0011-03, either individually or through a cooperative monitoring program, or alternative monitoring and reporting programs approved by Executive Officer as set forth in Finding 11 and Condition 11.

53. For Dischargers who choose to participate in a cooperative monitoring program, failure to pay cooperative monitoring program fees voids a selection or notification of the option to participate in a cooperative monitoring and hence requires individual monitoring report submittal per MRP Order No. R3-2012-0011, MRP Order No. R3-2012-0011-02, and MRP Order No. 2012-0011-03.

Part D. Submittal of Technical Reports for All Dischargers- Tier 1, Tier 2, Tier 3

Notice of Intent (NOI) to Enroll under the Order for All Dischargers in Tier 1, Tier 2 and Tier 3

54. Submittal of the electronic NOI is required pursuant to Water Code section 13260. Submittal of all other technical reports pursuant to this Order is required pursuant to Water Code section 13267. Failure to submit technical reports or the attachments in accordance with schedules established by this Order or MRP, or failure to submit a complete technical report (i.e., of sufficient technical quality to be acceptable to the Executive Officer), may subject the Discharger to enforcement action pursuant to Water Code sections 13261, 13268, or 13350. Dischargers must submit technical reports in the format specified by the Executive Officer.

55. Dischargers seeking authorization to discharge under this Order must submit a completed electronic NOI form to the Central Coast Water Board. Dischargers already enrolled in the 2004 Agricultural Order and who have submitted their NOI electronically are not required to submit a new NOI. Upon submittal of an accurate and complete electronic NOI, the Discharger is enrolled under the Order, unless otherwise informed by the Executive Officer.

    a. In the case where an operator may be operating for a period of less than 12 months, the landowner must submit the electronic NOI.

    b. **Within 60 days** of the adoption of this Order, any Discharger who did not enroll in the 2004 Agricultural Order must submit an electronic NOI, unless otherwise directed by the Executive Officer.

    c. **Prior to any discharge or commencement of activities that may cause a discharge,** including land preparation prior to crop production, any Discharger proposing to control or own a new operation or farm/ranch that has the potential to discharge waste that could directly or indirectly reach waters of the State and affect the quality of any surface water or groundwater must submit an electronic NOI.

    d. Dischargers must submit any updates to the electronic NOI by **October 1, 2012 and annually thereafter by October 1,** to reflect changes to operation or ranch/farm information.

    e. **Within 60 days**, in the event of a change in control or ownership of an operation, farm/ranch, or land presently owned or controlled by the

Discharger, the Discharger must notify the succeeding owner and operator of the existence of this Order by letter, and forward a copy of the letter to the Executive Officer.

f. **Within 60 days** of acquiring control or ownership of an operation or farm/ranch, any Discharger acquiring control or ownership of an existing operation or farm/ranch must submit an electronic NOI.

56. Dischargers must submit all the information required in the electronic NOI form including, but not limited to, the following information for the operation and individual farm/ranch:
    a. Identification of each property covered by enrollment,
    b. Tier applicable to each farm/ranch,
    c. Landowner(s),
    d. Operator(s),
    e. Contact information,
    f. Option selected to comply with surface receiving water quality monitoring conditions (cooperative monitoring or individual),
    g. Option selected to comply with groundwater monitoring conditions (cooperative monitoring or individual),
    h. Location of operation, including specific farm(s)/ranch(es),
    i. Farm/ranch map with discharge locations and groundwater wells identified,
    j. Total and irrigated acreage,
    k. Crop type,
    l. Irrigation type,
    m. Discharge type,
    n. Chemical use,
    o. Presence and location of any perennial, intermittent, or ephemeral streams or riparian or wetland area habitat.

57. Dischargers must submit a statement of understanding of the conditions of the Order and MRP signed by the Discharger (landowner or operator) with the electronic NOI form. If the operator signs and submits the electronic NOI, the operator must provide a copy of the completed NOI form to the landowner(s).

58. Dischargers must identify in the electronic NOI if the farm/ranch is a Tier 1, Tier 2, or Tier 3 and provide complete and accurate information in the NOI that allows the Central Coast Water Board to confirm the appropriate tier. For Dischargers who do not provide adequate information for the Water Board to confirm or determine the appropriate tier, the Executive Officer will place the farm/ranch in the appropriate tier based upon information submitted in the Notice of Intent or further communication with the Discharger.

59. Coverage under this Order is not transferable to any person except after submittal of an updated electronic NOI and approval by the Executive Officer.

60. For Dischargers who do not enroll in the Order in a timely manner as specified in this Order, the Executive Officer may require submittal of an ROWD, and the Discharger may be subject to WDRs.

Notice of Termination (NOT) for All Dischargers

61. **Immediately**, if a Discharger wishes to terminate coverage under the Order for the operation or an individual farm/ranch, the Discharger must submit a completed Notice of Termination (NOT). Termination from coverage is the date specified in the NOT, unless specified otherwise. All discharges, as defined in Attachment A, must cease before the date of termination, and any discharges on or after the date of termination shall be considered in violation of the Order, unless covered by other waivers of WDRs, general WDRs, or individual WDRs cover the discharge.

Monitoring and General Technical Reports for All Dischargers

62. Dischargers must submit monitoring reports in compliance with MRP Order No. R3-2012-0011, or alternative monitoring and reporting programs approved by Executive Officer as set forth in Finding 11 and Condition 11, electronically in a format specified by the Executive Officer.

63. Any laboratory data submitted to the Central Coast Water Board by Dischargers must be submitted by, or under the direction of, a State registered professional engineer, registered geologist, State certified laboratory or other similarly qualified professional. Surface water quality data must be submitted electronically, in a format that is compatible with the Central Coast Ambient Monitoring Program (CCAMP), the State's Surface Water Assessment Program (SWAMP) or as directed by the Executive Officer. Groundwater quality data must be submitted in a format compatible with the electronic deliverable format (EDF) used by the State Water Board's Geotracker data management system, or as directed by the Executive Officer.

64. Dischargers must submit technical reports that the Executive Officer may require to determine compliance with this Order as authorized by Water Code section 13267, electronically in a format specified by the Executive Officer.

65. If the Discharger asserts that all or a portion of a report submitted pursuant to this Order is subject to an exemption from public disclosure (e.g., trade secrets or secret processes), the Discharger must provide an explanation of how those portions of the reports are exempt from public disclosure. Also, the Discharger must clearly indicate on the cover of the report (typically an electronic submittal)

that the Discharger asserts that all or a portion of the report is exempt from public disclosure, submit a complete report with those portions that are asserted to be exempt in redacted form, submit separately (in a separate electronic file) unredacted pages (to be maintained separately by staff). The Central Coast Water Board staff will determine whether any such report or portion of a report qualifies for an exemption from public disclosure. If the Central Coast Water Board staff disagrees with the asserted exemption from public disclosure, the Central Coast Water Board staff will notify the Discharger prior to making such report or portions of such report available for public inspection. In the interest of public health and safety, the Central Coast Water Board will not make available for public inspection, the precise location of any groundwater well monitored in compliance with this Order. Consistent with the reporting of groundwater wells on GeoTracker, groundwater well location and data will only be referenced within a one-half mile radius of the actual well location.

66. Dischargers or a representative authorized by the Discharger must sign technical reports submitted to comply with the Order. Any person signing a report submitted as required by this Order must make the following certification:

"In compliance with Water Code section *13267, I certify under penalty of perjury that this document and all attachments were prepared by me, or under my direction or supervision, following a system designed to ensure that qualified personnel properly gather and evaluate the information submitted. To the best of my knowledge and belief, this document and all attachments are true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."*

Part E. Additional Conditions that Apply to Tier 2 and Tier 3 Dischargers

<u>Annual Compliance Reporting for Tier 2 and Tier 3 Dischargers</u>

67. By **October 1, 2012, and updated by October 1 annually thereafter**, Tier 2 and Tier 3 Dischargers must submit an Annual Compliance Form electronically, in a format specified by the Executive Officer that includes all the information requested, per MRP Order No. R3-2012-0011-02 and MRP Order No. R3-2012-0011-03, respectively. The purpose of the electronic Annual Compliance Form is to provide up-to-date information to the Central Coast Water Board to assist in the evaluation of affect on water quality from agricultural waste discharges and evaluate progress towards compliance with this Order, including implementation of management practices, treatment or control measures, or changes in farming practices.

68. **By October 1, 2012**, Tier 2 and Tier 3 Dischargers must determine nitrate loading risk factor(s) in accordance with MRP Order No. R3-2012-0011-02 and MRP Order No. R3-2012-0011-03 and report the nitrate loading risk factors and overall Nitrate Loading Risk level calculated for each ranch/farm or nitrate loading risk unit in the Annual Compliance Form, electronically (or in a format specified by the Executive Officer).

Photo Monitoring for Tier 2 and Tier 3 Dischargers with farms/ranches *adjacent to or containing* a waterbody identified on the 2010 List of Impaired Waterbodies as impaired for temperature, turbidity, or sediment

69. By **October 1, 2012,** and every four years thereafter, Tier 2 and Tier 3 Dischargers with farms/ranches adjacent to or containing a waterbody identified on the 2010 List of Impaired Waterbodies as impaired for temperature, turbidity, or sediment (identified in Table 1) must conduct photo monitoring per MRP Order No. R3-2012-0011-02 and MRP Order No. R3-2012-0011-03, respectively. Photo monitoring must document the condition of perennial, intermittent, or ephemeral streams and riparian and wetland area habitat, and demonstrate compliance with Basin Plan erosion and sedimentation requirements (see Part F. 80 of this Order), including the presence of bare soil vulnerable to erosion and relevant management practices and/or treatment and control measures implemented to address impairments. Photo documentation must be submitted electronically, in a format specified by the Executive Officer.

Total Nitrogen Reporting for Tier 2 and Tier 3 Dischargers with farms/ranches with High Nitrate Loading Risk

70. **By October 1, 2014 and by October 1 annually thereafter**, Tier 2 and Tier 3 Dischargers with a farm/ranch with High Nitrate Loading Risk must record and report total nitrogen applied in the Annual Compliance Form, electronically in a format specified by the Executive Officer, per MRP Order No. R3-2012-0011-02 and MRP Order No. R3-2012-0011-03, respectively.

71. As an alternative to reporting total nitrogen applied in the electronic Annual Compliance Form, Tier 2 and Tier 3 Dischargers with a farm/ranch with High Nitrate Loading Risk may propose an individual discharge groundwater monitoring and reporting program (GMRP) plan for approval by the Executive Officer. The GMRP plan must evaluate waste discharge to groundwater from each ranch/farm or nitrate loading risk unit with a High Nitrate Loading Risk.

Part F. Additional Conditions that Apply to Tier 3 Dischargers

72. **By October 1, 2013,** Tier 3 Dischargers must initiate individual surface water discharge monitoring per MRP Order No. R3-2012-0011-03 or alternative monitoring and reporting programs approved by Executive Officer as set forth in Finding 11 and Condition 11.

73. **By March 15, 2014, October 1, 2014** and annually thereafter by October 1, Tier 3 Dischargers must submit individual surface water discharge monitoring data and reports per MRP Order No. R3-2012-0011-03, electronically, in a format specified by the Executive Officer, or alternative monitoring and reporting programs approved by Executive Officer as set forth in Finding 11 and Condition 11 .

<u>Irrigation and Nutrient Management Plan for Tier 3 Dischargers with farms/ranches with High Nitrate Loading Risk</u>

74. **By October 1, 2013,** Tier 3 Dischargers with High Nitrate Loading Risk farms/ranches must determine the typical crop nitrogen uptake for each crop type produced and report the basis for the determination (e.g., developed by commodity or industry group, published agronomic literature, research trials, site specific analysis of dry biomass of crop for the nitrogen concentration), per MRP Order No. R3-2012-0011-03.

75. Tier 3 Dischargers with High Nitrate Loading Risk farms/ranches must develop and initiate implementation of an Irrigation and Nutrient Management Plan (INMP) certified by a Professional Soil Scientist, Professional Agronomist, or Crop Advisor certified by the American Society of Agronomy, or similarly qualified professional, per MRP Order No. R3-2012-0011-03.

76. As an alternative to the development and implementation of an INMP, Tier 3 Dischargers with High Nitrate Loading Risk farms/ranches may propose an individual discharge groundwater monitoring and reporting program (GMRP) plan for approval by the Executive Officer. The GMRP plan must evaluate waste discharge to groundwater from each ranch/farm or nitrate loading risk unit and assess if the waste discharge is of sufficient quality that it will not cause or contribute to exceedances of any nitrate water quality standards in groundwater.

77. **By October 1, 2015 and annually thereafter,** Tier 3 Dischargers with High Nitrate Loading Risk farms/ranches must report specific INMP elements in the Annual Compliance Form per MRP Order No. R3-2012-0011-03, electronically in a format specified by the Executive Officer.

78. **By October 1, 2015,** Tier 3 Dischargers with High Nitrate Loading Risk farms/ranches must report progress towards the following Nitrogen Balance ratio

milestones or implement an alternative to demonstrate an equivalent nitrogen load reduction. The Nitrogen Balance ratio refers to the total number of nitrogen units applied to the crop (considering all sources of nitrogen) relative to the typical nitrogen uptake value of the crop (crop need to grow and produce, amount removed at harvest plus the amount remaining in the system as biomass).

a. Dischargers producing crops in annual rotation (such as a cool season vegetable in a triple cropping system) must report progress towards a Nitrogen Balance ratio target equal to one (1). A target of one (1) allows a Discharger to apply 100% of the amount of nitrogen required by the crop to grow and produce yield for every crop in the rotation. (Nitrogen applied includes any product, form or concentration, including but not limited to, organic and inorganic fertilizers, slow release products, compost, compost teas, manure, extracts, nitrogen present in the soil and nitrate in irrigation water.)

b. Dischargers producing annual crops occupying the ground for the entire year (e.g., strawberries or raspberries) must report progress towards a Nitrogen Balance ratio target equal to 1.2. A target of 1.2 allows a Discharger to apply 120% of the amount of nitrogen required by the crop to grow and produce a yield.

c. Beyond three years, Dischargers must demonstrate improved irrigation and nutrient management efficiency, improved Nitrogen Balance ratios, and reduced nitrate loading to groundwater. In the long term, the Nitrogen Balance ratio should compare the total amount of nitrogen applied to the crop against the total nitrogen removed at harvest, rather than the typical nitrogen crop uptake, to accurately calculate the nitrogen remaining and available to the crop or that could load to groundwater.

79. **By October 1, 2016,** Tier 3 Dischargers with High Nitrate Loading Risk farms/ranches must verify the overall effectiveness of the INMP per MRP Order No. R3-2012-0011-03. Dischargers must identify the methods used to verify effectiveness and include the results as a report with the Annual Compliance Form, submitted electronically in a format specified by the Executive Officer.

<u>Water Quality Buffer Plan for Tier 3 Dischargers with farms/ranches adjacent to or containing a waterbody identified on the 2010 List of Impaired Waterbodies as impaired for temperature, turbidity, or sediment</u>

80. **By October 1, 2016,** Tier 3 Dischargers with farms/ranches adjacent to or containing a waterbody identified on the 2010 List of Impaired Waterbodies as impaired for temperature, turbidity, or sediment (see Table 1) must develop a Water Quality Buffer Plan per MRP Order No. R3-2012-0011-03 that protects the

listed waterbody and its associated perennial and intermittent tributaries, including adjacent wetlands as defined by the Clean Water Act. Dischargers must submit the Water Quality Buffer Plan as a report with the Annual Compliance Form, submitted electronically in a format specified by the Executive Officer. The purpose of the Water Quality Buffer Plan is to control discharges of waste that cause or contribute to exceedances of water quality standards in waters of the State or United States in compliance with this Order and the following Basin Plan requirement:

a. Basin Plan (Chapter 5, p. V-13, Section V.G.4 – Erosion and Sedimentation, *"A filter strip of appropriate width, and consisting of undisturbed soil and riparian vegetation or its equivalent, shall be maintained, wherever possible, between significant land disturbance activities and watercourses, lakes, bays, estuaries, marshes, and other water bodies. For construction activities, minimum width of the filter strip shall be thirty feet, wherever possible. .."*

b. As an alternative to the development and implementation of a Water Quality Buffer Plan, Tier 3 Dischargers may submit evidence to the Executive Officer to demonstrate that any discharge of waste is sufficiently treated or controlled such that it is of sufficient quality that it will not cause or contribute to exceedances of water quality standards in waters of the State or of the United States.

81. Tier 3 Dischargers with farms/ranches adjacent to or containing a waterbody identified on the 2010 List of Impaired Waterbodies as impaired for temperature, turbidity, or sediment must implement the Water Quality Buffer Plan immediately upon submittal, unless the plan requests a time extension that is approved by the Executive Officer. If the Executive Officer determines the Water Quality Buffer Plan is not in compliance with this Order, the Executive Officer will notify the Discharger and the Discharger must make necessary modifications accordingly.

Part G. TIME SCHEDULE

82. Time schedules for compliance with conditions are identified in Conditions 84 – 87, and described in Table 2 (all Dischargers) and Table 3 (Tier 2 and Tier 3 Dischargers). Milestones are identified in Table 4. Dischargers must comply with Order Conditions by dates specified in Tables 2 and 3 in accordance with the MRP. The Water Board will consider the following information in determining the extent to which the Discharger is effectively controlling individual waste discharges and compliance with this Order:
   a) compliance with the time schedules;
   b) effectiveness of management practice implementation;

c) effectiveness of treatment or control measures (including cooperative water quality improvement efforts, and local and regional treatment strategies);
d) results of individual discharge monitoring (Tier 3);
e) results of surface receiving water monitoring downstream of the point where the individual discharge enters the receiving water body;
f) other information obtained by Water Board staff during inspections at operations or farms/ranches, or submitted in response to Executive Officer orders;

83. The Executive Officer may require additional monitoring and reporting as authorized by Water Code section 13267 in cases where Dischargers fail to demonstrate adequate progress towards compliance as indicated by milestones and compliance with other Conditions of the Order.

84. **By October 1, 2014**, Tier 3 Dischargers must effectively control individual waste discharges of pesticides and toxic substances to waters of the State and of the United States.

85. **By October 1, 2015**, Tier 3 Dischargers must effectively control individual waste discharges of sediment and turbidity to surface waters of the State or of the United States.

86. **By October 1, 2016**, Tier 3 Dischargers must effectively control individual waste discharges of nutrients to surface waters of the State or of the United States.

87. **By October 1, 2016,** Tier 3 Dischargers must effectively control individual waste discharges of nitrate to groundwater.

88. This Order becomes effective on March 15, 2012 and expires on March 14, 2017, unless rescinded or renewed by the Central Coast Water Board.

I, Roger W. Briggs, Executive Officer, do hereby certify the foregoing is a full, true, and correct copy of an Order and Attachments adopted by the California Regional Water Quality Control Board, Central Coast Region, on March 15, 2012.

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Roger W. Briggs
Executive Officer

Table 1. 2010 Clean Water Act Section 303(d) List of Impaired Waterbodies Impaired for Toxicity, Pesticides, Nutrients, Temperature, Turbidity, or Sediment

Waterbody Name	Impairment(s)[1]
Alisal Creek (Monterey Co.) [3]	Toxicity, Nutrients
Aptos Creek[2]	Sediment
Arana Gulch[3]	Pesticides
Arroyo Paredon[3]	Toxicity, Pesticides, Nutrients
Beach Road Ditch[2]	Nutrients, Turbidity
Bean Creek[2]	Sediment
Bear Creek (Santa Cruz Co.)[2]	Sediment
Bell Creek (Santa Barbara Co.) [3]	Toxicity, Nutrients
Blanco Drain[2,3]	Pesticides, Nutrients, Turbidity
Blosser Channel	Toxicity, Nutrients
Boulder Creek[2]	Sediment
Bradley Canyon Creek[2,3]	Toxicity, Nutrients, Turbidity
Bradley Channel[3]	Toxicity, Pesticides, Nutrients
Branciforte Creek[2,3]	Pesticides, Sediment
Carbonera Creek[2]	Nutrients, Sediment
Carnadero Creek	Nutrients, Turbidity
Carneros Creek (Monterey Co.) [2]	Nutrients, Turbidity
Carpinteria Creek[3]	Pesticides
Carpinteria Marsh (El Estero Marsh)	Nutrients
Casmalia Canyon Creek[2]	Sediment
Chorro Creek[2]	Nutrients, Sediment
Chualar Creek[2,3]	Toxicity, Pesticides, Nutrients, Turbidity, Temperature
Corralitos Creek[2]	Turbidity
Elkhorn Slough[2,3]	Pesticides, Sediment
Esperanza Creek	Nutrients
Espinosa Lake[3]	Pesticides
Espinosa Slough[2,3]	Toxicity, Pesticides, Nutrients, Turbidity
Fall Creek[2]	Sediment
Franklin Creek (Santa Barbara Co.)[3]	Pesticides, Nutrients
Furlong Creek[2,3]	Pesticides, Nutrients, Turbidity
Gabilan Creek[2,3]	Toxicity, Nutrients, Turbidity
Glen Annie Canyon[3]	Toxicity, Nutrients

Greene Valley Creek (Santa Barbara Co.) [2,3]	Toxicity, Pesticides, Nutrients, Turbidity, Temperature
Kings Creek[2]	Sediment
Little Oso Flaco Creek[3]	Toxicity, Nutrients
Llagas Creek (below Chesbro Reservoir) [2,3]	Pesticides, Nutrients, Sediment, Turbidity
Lompico Creek[2]	Nutrients, Sediment
Los Berros Creek	Nutrients
Los Carneros Creek	Nutrients
Los Osos Creek[2]	Nutrients, Sediment
Love Creek[2]	Sediment
Main Street Canal[2,3]	Toxicity, Pesticides, Nutrients, Turbidity
McGowan Ditch	Nutrients
Merrit Ditch[2,3]	Toxicity, Nutrients, Turbidity
Millers Canal[2,3]	Pesticides, Turbidity, Temperature
Mission Creek (Santa Barbara Co.)[3]	Toxicity
Monterey Harbor[3]	Toxicity
Moro Cojo Slough[2,3]	Pesticides, Nutrients, Sediment
Morro Bay[2]	Sediment
Moss Landing Harbor[2,3]	Toxicity, Pesticides, Sediment
Mountain Charlie Gulch[2]	Sediment
Natividad Creek[2,3]	Toxicity, Nutrients, Turbidity, Temperature
Newell Creek (Upper) [2]	Sediment
Nipomo Creek[3]	Toxicity, Nutrients
North Main Street Channel	Nutrients
Old Salinas River Estuary[3]	Pesticides, Nutrients
Old Salinas River[2,3]	Toxicity, Pesticides, Nutrients, Turbidity
Orcutt Creek[2,3]	Toxicity, Pesticides, Nutrients, Turbidity, Temperature
Oso Flaco Creek[3]	Toxicity, Nutrients
Oso Flaco Lake[3]	Pesticides, Nutrients
Pacheco Creek[2]	Turbidity
Pacific Ocean (Point Ano Nuevo to Soquel Point)[3]	Pesticides
Pajaro River[2,3]	Pesticides, Nutrients, Sediment, Turbidity
Prefumo Creek[2]	Nutrients, Turbidity
Quail Creek[2,3]	Toxicity, Pesticides, Nutrients, Turbidity, Temperature
Rider Creek[2]	Sediment
Rincon Creek[2,3]	Toxicity, Turbidity
Rodeo Creek Gulch[2]	Turbidity

Salinas Reclamation Canal[2,3]	Toxicity, Pesticides, Nutrients, Turbidity
Salinas River (lower, estuary to near Gonzales Rd crossing, watersheds 30910 and 30920) [2,3]	Toxicity, Pesticides, Nutrients, Turbidity
Salinas River (middle, near Gonzales Rd crossing to confluence with Nacimiento River) [2,3]	Toxicity, Pesticides, Turbidity, Temperature
Salinas River Lagoon (North) [3]	Pesticides, Nutrients
Salinas River Refuge Lagoon (South) [2]	Turbidity
Salsipuedes Creek (Santa Cruz Co.) [2]	Turbidity
San Antonio Creek (below Rancho del las Flores Bridge at Hwy 135) [3]	Pesticides, Nutrients
San Benito River[2,3]	Toxicity, Sediment
San Juan Creek (San Benito Co.) [2,3]	Toxicity, Nutrients, Turbidity
San Lorenzo River[2,3]	Pesticides, Nutrients, Sediment
San Luis Obispo Creek (below Osos St.) [3]	Pesticides, Nutrients
San Simeon Creek	Nutrients
San Vicente Creek (Santa Cruz Co.) [2]	Sediment
Santa Maria River[2,3]	Toxicity, Pesticides, Nutrients, Turbidity
Santa Rita Creek (Monterey Co.) [2]	Nutrients, Turbidity
Santa Ynez River (below city of Lompoc to Ocean)[2]	Nutrients, Sediment, Temperature
Santa Ynez River (Cachuma Lake to below city of Lompoc)	Sediment, Temperature
Schwan Lake	Nutrients
Shingle Mill Creek[2]	Nutrients, Sediment
Shuman Canyon Creek[2]	Sediment
Soda Lake	Nutrients
Soquel Creek[2]	Turbidity
Soquel Lagoon[2]	Sediment
Tembladero Slough[2,3]	Toxicity, Pesticides, Nutrients, Turbidity
Tequisquita Slough[2]	Turbidity
Uvas Creek (below Uvas Reservoir) [2]	Turbidity
Valencia Creek[2]	Sediment
Warden Creek	Nutrients
Watsonville Creek	Nutrients
Watsonville Slough[2,3]	Pesticides, Turbidity
Zayante Creek[2,3]	Pesticides, Sediment

[1]Dischargers with farms/ranches located within 1000 feet of a surface waterbody listed for toxicity, pesticides, nutrients, turbidity or sediment on the 2010 List of Impaired Waterbodies are included as Tier 2 or Tier 3;
[2]Tier 2 and Tier 3 Dischargers with farms/ranches adjacent to or containing a waterbody identified on the 2010 List of Impaired Waterbodies as impaired for temperature, turbidity, or sediment must conduct photo monitoring, and Tier 3 Dischargers must also implement a Water Quality Buffer Plan.

[3]Dischargers who apply chemicals known to cause toxicity to surface water to a farm/ranch that discharges to a waterbody on the 2010 303(d) List of Impaired Waterbodies for toxicity or pesticides must meet conditions in this Order for Tier 3.

Table 2. Time Schedule for Compliance with Conditions for All Dischargers (Tier 1, Tier 2, and Tier 3)

CONDITIONS	COMPLIANCE DATE[1]
Submit Notice of Intent (NOI)	Within 60 days of adoption of Order or Within 60 days acquiring ownership/ control, and prior to any discharge or commencement of activities that may cause discharge.
Submit Update to NOI	Within 60 days, upon adoption of Order and upon change of control or ownership
Submit Notice of Termination	Immediately, when applicable
Submit Monitoring Reports per MRP	Per date in MRP
Implement, and update as necessary, management practices to achieve compliance with this Order.	Ongoing
Protect existing aquatic habitat to prevent discharge of waste	Immediately
Submit surface receiving water quality monitoring annual report	Within one year, and annually thereafter by January 1
Develop/update and implement Farm Plan	October 1, 2012
Install and maintain adequate backflow prevention devices.	October 1, 2012
Submit groundwater monitoring results and information	October 1, 2013
Properly destroy abandoned groundwater wells.	October 1, 2015

Table 3. Additional Time Schedule for Compliance with Conditions Tier 2 and Tier 3 Dischargers

CONDITIONS	COMPLIANCE DATE
Tier 2 and Tier 3:	
Submit electronic Annual Compliance Form	October 1, 2012, and updated annually thereafter by October 1.
Submit photo documentation of riparian or wetland area habitat (if farm/ranch contains or is adjacent to a waterbody impaired for temperature, turbidity, or sediment)	October 1, 2012, and every four years thereafter by October 1.
Calculate Nitrate Loading Risk level and report in electronic Annual Compliance Form	October 1, 2012, and annually thereafter by October 1.
Submit total nitrogen applied in electronic Annual Compliance Form (if discharge has High Nitrate Loading Risk)	October 1, 2014, and annually thereafter by October 1.
Only Tier 3:	
Initiate individual surface water discharge monitoring	October 1, 2013
Determine Crop Nitrogen Uptake (if discharge has High Nitrate Loading Risk)	October 1, 2013
Submit individual surface water discharge monitoring data	March 15, 2014, October 1, 2014 and annually thereafter by October 1
Submit INMP elements in electronic Annual Compliance Form (if discharge has High Nitrate Loading Risk), including Nitrogen Balance Ratio	October 1, 2015, and annually thereafter by October 1
Submit progress towards Nitrogen Balance Ratio target equal to one (1) for crops in annual rotation (e.g., cool season vegetables) or alternative, (if discharge has High Nitrate Loading Risk)	October 1, 2015
Submit progress towards Nitrogen Balance Ratio target equal to 1.2 for annual crops occupying the ground for the entire year (e.g., strawberries or raspberries) or alternative, (if discharge has High Nitrate Loading Risk)	
Submit Water Quality Buffer Plan or alternative (if farm/ranch contains or is adjacent to a waterbody impaired for temperature, turbidity, or sediment)	October 1, 2016
Submit INMP Effectiveness Report (if discharge has High Nitrate Loading Risk)	October 1, 2016

Table 4. Time Schedule for Milestones

MILESTONES[1]	DATE
Tier 1, Tier 2 and Tier 3:	
Measurable progress towards water quality standards in waters of the State or of the United States[1], or Water quality standards met in waters of the State or of the United States.	Ongoing October 1, 2016
Only Tier 3:	
<u>Pesticide and Toxic Substances Waste Discharges to Surface Water</u> *- One of two individual surface water discharge monitoring samples is not toxic* *- Two of two individual surface water discharge monitoring samples are not toxic*	 *October 1, 2014* *October 1, 2015*
<u>Sediment and Turbidity Waste Discharges to Surface Water</u> *- Four individual surface water discharge monitoring samples are collected and analyzed for turbidity.* *- 75% reduction in turbidity or sediment load in individual surface water discharge relative to October 1, 2012 load (or meet water quality standards for turbidity or sediment in individual surface water discharge)*	 *October 1, 2014* *October 1, 2015*
<u>Nutrient Waste Discharges to Surface Water</u> *- Four individual surface water discharge monitoring samples are collected and analyzed* *- 50% load reduction in nutrients in individual surface water discharge relative to October 1, 2012 load (or meet water quality standards for nutrients in individual discharge)*	 *October 1, 2014* *October 1, 2015*

- 75% load reduction in nutrients in individual surface water discharge relative to October 1, 2012 load (or meet water quality standards for nutrients in individual surface water discharge)	*October 1, 2016*
Nitrate Waste Discharges to Groundwater *- Achieve annual reduction in nitrogen loading to groundwater based on Irrigation and Nutrient Management Plan effectiveness and load evaluation*	*October 1, 2016 and annually thereafter*
- Achieve Nitrogen Balance Ratio equal to one (1) for crops in annual rotation (e.g., cool season vegetables) or alternative, (if discharge has High Nitrate Loading Risk)	October 1, 2015
- Achieve Nitrogen Balance Ratio equal to 1.2 for annual crops occupying the ground for the entire year (e.g., strawberries or raspberries) or alternative, (if discharge has High Nitrate Loading Risk)	

[1] Indicators of progress towards milestones includes, but is not limited to data and information related to a) management practice implementation and effectiveness, b) treatment or control measures, c) individual discharge monitoring results, d) receiving water monitoring results, and e) related reporting.

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD CENTRAL COAST REGION

ORDER NO. R3-2012-0011 ATTACHMENT A

ADDITIONAL FINDINGS, APPLICABLE WATER QUALITY CONTROL PLANS AND DEFINITIONS FOR CONDITIONAL WAIVER OF WASTE DISCHARGE REQUIREMENTS FOR DISCHARGES FROM IRRIGATED LANDS

Order No. R3-2012-0011 (Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands) requires Dischargers to comply with applicable state plans and policies and applicable state and federal water quality standards and to prevent nuisance. Water quality standards are set forth in state and federal plans, policies, and regulations. The California Regional Water Quality Control Board Central Coast Region's (Central Coast Water Board) Water Quality Control Plan contains specific water quality objectives, beneficial uses, and implementation plans that are applicable to discharges of waste and/or waterbodies that receive discharges of waste from irrigated lands. The State Water Resources Control Board (State Water Board) has adopted plans and policies that may be applicable to discharges of waste and/or surface waterbodies or groundwater that receive discharges of waste from irrigated lands. The United States Environmental Protection Agency (USEPA) has adopted the *National Toxics Rule* and the *California Toxics Rule*, which constitute water quality criteria that apply to waters of the United States.

The specific waste constituents required to be monitored and the applicable water quality standards that protect identified beneficial uses for the receiving water are set forth in Monitoring and Reporting Program (MRP) Order No. R3-2012-0011-01, MRP Order No. R3-2012-0011-02, and MRP Order No. R3-2012-0011-03.

This Attachment A lists additional findings (Part A), relevant plans, policies, regulations (Part B), and definitions of terms (Part C) used in Order No. R3-2012-0011.

PART A. ADDITIONAL FINDINGS

The California Regional Water Quality Control Board, Central Coast Region additionally finds that:

1. The Central Coast Water Board is the principal state agency in the Central Coast Region with primary responsibility for the coordination and control of water quality. (Cal. Wat. Code § 13001, Legislative Intent) The purpose of this Order is to is focus on the highest water quality priorities and maximize water quality protection to ensure the long-term reliability and availability of water resources of sufficient supply and quality for all present and future beneficial uses, including drinking water and aquatic life. Given the magnitude and severity of water quality impairment and impacts to beneficial uses caused by irrigated agriculture and the significant cost to the public, the Central Coast Water Board finds that it is reasonable and necessary to require specific actions to protect water quality.

2. The Central Coast Water Board recognizes that Dischargers may not achieve immediate compliance with all requirements. Thus, this Order provides reasonable schedules for Dischargers to reach full compliance over many years by implementing management practices and monitoring and reporting programs that demonstrate and verify measurable progress annually. This Order includes specific dates to achieve compliance with this Order and milestones that will reduce pollutant loading or impacts to surface water and groundwater in the short term (e.g., a few years) and achieve water quality standards in surface water and groundwater in the longer term (e.g., decades); some compliance dates extend beyond the term of this Order. The focus of this Order is non-tile drain discharges, although Tier 3 tile drain discharges on individual farms/ranches must be monitored. Dischargers with tile drains must also describe management practices used or proposed to be used to attain water quality standards or minimize exceedances in receiving waters while making progress to attain water quality standards. The Executive Officer will evaluate any proposed longer timeframes to address tile-drain discharges.

3. According to California Water Code Section 13263(g), the discharge of waste to waters of the State is a privilege, not a right. It is the responsibility of dischargers of waste from irrigated lands to comply with the Water Code by seeking waste discharge requirements (WDRs) or by complying with a waiver of WDRs. This Order waiving the requirement to obtain WDRs provides a mechanism for dischargers of waste from irrigated lands to meet their responsibility to comply with the Water Code and to prevent degradation of waters of the State, prevent nuisance, and to protect the beneficial uses. Dischargers are responsible for the quality of surface waters and ground waters that have received discharges of waste from their irrigated lands.

AGRICULTURAL AND WATER RESOURCES IN THE CENTRAL COAST REGION

4. In the Central Coast Region, nearly all agricultural, municipal, industrial, and domestic water supply comes from groundwater. Groundwater supplies approximately 90 percent of the drinking water on the Central Coast. Currently, more than 700 municipal public supply wells in the Central Coast Region provide drinking water to the public. In addition, based on 1990 census data, there are more than 40,000 permitted private wells in the Region, most providing domestic drinking water to rural households and communities from shallow sources. The number of private domestic wells has likely significantly increased in the past 20 years due to population growth.

5. In the Salinas, Pajaro, and Santa Maria groundwater basins, agriculture accounts for approximately 80 to 90 percent of groundwater pumping (MCWRA, 2007; PVWMA, 2002; Luhdorff and Scalmanini Consulting Engineers. April 2009).

6. The Central Coast Region supports some of the most significant biodiversity of any temperate region in the world and is home to the last remaining population of the California sea otter, three sub-species of threatened or endangered steelhead (*Oncorhynchus mykiss*) and one sub-species of endangered coho salmon (*Oncorhynchus kisutch*). The endangered marsh sandwort (*Arenaria paludicola*), Gambel's watercress (*Nasturtium rorippa gambelii*), California least tern (*Sterna antillarum browni*), and threatened red-legged frog (*Rana aurora*) are present in the region.

7. Several watersheds drain into Monterey Bay National Marine Sanctuary, one of the largest marine sanctuaries in the world. Elkhorn Slough is one of the largest remaining tidal wetlands in the United States and one of the National Oceanic and Atmospheric Administration (NOAA) designated National Estuarine Research Reserves. The southern portion includes the Morro Bay National Estuary and its extensive salt marsh habitat.

8. The two endangered plants, marsh sandwort and Gambel's watercress, are critically imperiled and their survival depends upon the health of the Oso Flaco watershed. The last remaining known population of marsh sandwort and one of the last two remaining known populations of Gambel's watercress occur in Oso Flaco Lake (United States Department of the Interior Fish and Wildlife Service, 2007).

9. The Central Coast of California is one of the most productive and profitable agricultural regions in the nation, reflecting a gross production value of more than six billion dollars in 2008 and contributing to more than 14 percent of California's agricultural economy. The region produces many high value specialty crops including lettuce, strawberries, raspberries, artichokes, asparagus, broccoli, carrots, cauliflower, celery, fresh herbs, mushrooms, onions, peas, spinach, wine

grapes, tree fruit and nuts. An adequate water supply of sufficient quality is critical to supporting the agricultural industry on the Central Coast.

LEGAL AND REGULATORY CONSIDERATIONS

10. This Attachment A to Order No. R3-2012-0011 identifies applicable plans and policies adopted by the State Water Board and the Central Coast Water Board that contain regulatory requirements that apply to the discharge of waste from irrigated lands. This Attachment A also provides definitions of terms for purposes of this Order.

11. The Water Code grants authority to the State Water Board with respect to State water rights and water quality regulations and policy, and establishes nine Regional Water Boards with authority to regulate discharges of waste that could affect the quality of waters of the State and to adopt water quality regulations and policy.

12. As further described in the Order, discharges from irrigated lands affect the quality of the waters of the State depending on the quantity of the waste discharge, quantity of the waste, the quality of the waste, the extent of treatment, soil characteristics, distance to surface water, depth to groundwater, crop type, implementation of management practices and other site-specific factors. Discharges from irrigated lands have impaired and will continue to impair the quality of the waters of the State within the Central Coast Region if such discharges are not controlled.

13. Water Code Section 13267(b)(1) authorizes the Central Coast Water Board to require dischargers to submit technical reports necessary to evaluate Discharger compliance with the terms and conditions of this Order and to assure protection of waters of the State. The Order, this Attachment A, and the records of the Water Board provide the evidence demonstrating that discharges of waste from irrigated lands have degraded and/or polluted the waters of the state. Persons subject to this Order discharge waste from irrigated lands that impacts the quality of the waters of the state. Therefore it is reasonable to require such persons to prepare and submit technical reports.

14. Water Code Section 13269 provides that the Central Coast Water Board may waive the requirement in Water Code section 13260(a) to obtain WDRs. Water Code section 13269 further provides that any such waiver of WDRs shall be conditional, must include monitoring requirements unless waived, may not exceed five years in duration, and may be terminated at any time by the Central Coast Water Board or Executive Officer.

15. Water Code Section 13269(a)(4)(A) authorizes the Central Coast Water Board to include as a condition of a conditional waiver the payment of an annual fee established by the State Water Board. California Code of Regulations, Title 23, Division 3, Chapter 9, Article 1, Section 2200.3 sets forth the applicable fees. The Order requires each Discharger to pay an annual fee to the State Water Board in compliance with the fee schedule.

16. The Water Quality Control Plan for the Central Coast Basin (Basin Plan) designates beneficial uses, establishes water quality objectives, contains programs of implementation needed to achieve water quality objectives, and references the plans and policies adopted by the State Water Board. The water quality objectives are required to protect the beneficial uses of waters of the State identified in this Attachment A.

17. The Order is consistent with the Basin Plan because it requires Dischargers to comply with applicable water quality standards, as defined in this Attachment A, and requires terms and conditions, including implementation of management practices. The Order also requires monitoring and reporting as defined in MRP Order No. R3-2012-0011-01, MRP Order No. R3-2012-0011-02, and MRP Order No. R3-2012-0011-03 to determine the effects of discharges of waste from irrigated lands on water quality, verify the adequacy and effectiveness of this Order's terms and conditions, and to evaluate individual Discharger's compliance with this Order.

18. Water Code Section 13246 requires boards, in carrying out activities that affect water quality to comply with State Water Board policy for water quality control. This Order requires compliance with applicable State Water Board policies for water quality control.

19. This Order is consistent with the requirements of the *Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program* (NPS Policy) adopted by the State Water Board in May 2004. The NPS Policy requires, among other key elements, that an NPS control implementation program's ultimate purpose shall be explicitly stated and that the implementation program must, at a minimum, address NPS pollution in a manner that achieves and maintains water quality objectives and beneficial uses, including any applicable anti-degradation requirements. The NPS Policy improves the State's ability to effectively manage NPS pollution and conform to the requirements of the Federal Clean Water Act and the Federal Coastal Zone Act Reauthorization Amendments of 1990. The NPS Policy provides a bridge between the State Water Board's January 2000 *NPS Program Plan* and its 2010 *Water Quality Enforcement Policy*. The NPS Policy's five key elements are:

a. Key Element #1 - Addresses NPS pollution in a manner that achieves and maintains water quality objectives and beneficial uses
b. Key Element #2 - Includes an implementation program with descriptions of the Management Practices (MPs) and other program elements and the process to be used to ensure and verify proper MP implementation
c. Key Element #3 - Includes a specific time schedule and corresponding quantifiable milestones designed to measure progress toward reaching the specified requirements
d. Key Element #4 - Contains monitoring and reporting requirements that allow the Water Board, dischargers, and the public to determine that the program is achieving its stated purpose(s) and/or whether additional or different MPs or other actions are required
e. Key Element #5 - Clearly discusses the potential consequences for failure to achieve the NPS control implementation program's stated purposes

20. Consistent with the NPS Policy, management practice implementation assessment may, in some cases, be used to measure nonpoint source control progress. However, management practice implementation never may be a substitute for meeting water quality requirements.

21. This Order is consistent with provisions of State Water Resources Control Board Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality of Waters in California." Regional boards, in regulating the discharge of waste, must maintain high quality waters of the State until it is demonstrated that any change in quality will be consistent with maximum benefit to the people of the State, will not unreasonably affect beneficial uses, and will not result in water quality less than that described in the Regional Board's policies. The Order will result in improved water quality throughout the region. Dischargers must comply with all applicable provisions of the Basin Plan, including water quality objectives, and implement best management practices to prevent pollution or nuisance and to maintain the highest water quality consistent with the maximum benefit to the people of the State. The conditions of this waiver will protect high quality waters and restore waters that have already experienced some degradation.

22. This Order is consistent with State Water Board Resolution 68-16. This Order requires Dischargers to 1) comply with the terms and conditions of the Order and meet applicable water quality standards in the waters of the State; 2) develop and implement management practices, treatment or control measures, or change farming practices, when discharges are causing or contributing to exceedances of applicable water quality standards; 3) conduct activities in a manner to prevent nuisance; and 4) conduct activities required by MRP Order No. R3-2012-0011-01, MRP Order No. R3-2012-0011-02, and MRP Order No. R3-2012-0011-03, and revisions thereto.

RATIONALE FOR THIS ORDER

23. On April 15, 1983, the Central Coast Water Board approved a policy waiving WDRs for 26 categories of discharges, including irrigation return flows and non-NPDES stormwater runoff. Pursuant to Water Code Section 13269, these waivers terminated on January 1, 2003.

24. On July 9, 2004, the Central Coast Water Board adopted Resolution No. R3-2004-0117 establishing the 2004 Agricultural Order.

25. Dischargers enrolled in the 2004 Agricultural Order established the Cooperative Monitoring Program (CMP) in compliance with monitoring requirements. The CMP collected and analyzed data for 15 to 20 parameters from 50 sites in multiple watersheds and identified severe surface water quality impairments resulting from agricultural land uses and discharges. CMP did not attempt to identify the individual farm operations that are causing the surface water quality impairments. The lack of discharge monitoring and reporting, the lack of verification of on-farm water quality improvements, and the lack of public transparency regarding on-farm discharges, are critical limitations of the 2004 Agricultural Order, especially given the scale and severity of the surface water and groundwater impacts and the resulting costs to society. The Order addresses these limitations.

26. The Central Coast Water Board extended the 2004 Agricultural Order multiple times. The 2004 Agricultural Order expires on September 30, 2012.

27. The Central Coast Water Board reviewed all available data, including information collected in compliance with the 2004 Agricultural Order, and determined that discharges of waste from irrigated lands continue to result in degradation and pollution of surface water and groundwater, and impairment of beneficial uses, including drinking water and aquatic habitat, and determined that additional conditions are necessary to ensure protection of water quality and to measure the effectiveness of implementation of the Order.

28. It is appropriate to adopt a waiver of WDRs for this category of discharges because, as a group, the discharges have the same or similar waste from the same or similar operations and use the same or similar treatment methods and management practices (e.g., source control, reduced agricultural surface runoff, reduced chemical use, holding times, cover crops, etc.).

29. It is appropriate to regulate discharges of waste from irrigated lands under a conditional waiver rather than individual WDRs in order to simplify and streamline the regulatory process. Water Board staff estimate that there are more than 3000 individual owners and/or operators of irrigated lands who discharge waste from

irrigated lands; therefore, it is not an efficient use of resources to adopt individual WDRs for all Dischargers within a reasonable time.

30. This Order is in the public interest because:

    a. The Order was adopted in compliance with Water Code Sections 13260, 13263, and 13269 and other applicable law;
    b. The Order requires compliance with water quality standards;
    c. The Order includes conditions that are intended to eliminate, reduce and prevent pollution and nuisance and protect the beneficial uses of the waters of the State;
    d. The Order contains more specific and more stringent conditions for protection of water quality compared to the 2004 Agricultural Order;
    e. The Order contains conditions that are similar to the conditions of municipal stormwater NPDES permits, including evaluation and implementation of management practices to meet applicable water quality standards and a more specific MRP;
    f. The Order focuses on the highest priority water quality issues and most severely impaired waters;
    g. The Order provides for an efficient and effective use of Central Coast Water Board resources, given the magnitude of the discharges and number of persons who discharge waste from irrigated lands;
    h. The Order provides reasonable flexibility for the Dischargers who seek coverage under this Order by providing them with a reasonable time schedule and options for complying with the Water Code.

31. This Order waives the requirement for Dischargers to obtain WDRs for discharges of waste from irrigated lands if the Dischargers are in compliance with the Order. This Order is conditional, may be terminated at any time, does not permit any illegal activity, does not preclude the need for permits that may be required by other State or local government agencies, and does not preclude the Central Coast Water Board from administering enforcement remedies (including civil liability) pursuant to the Water Code.

32. The Central Coast Water Board may consider issuing individual WDRs to some Dischargers because of their actual or potential contribution to water quality impairments, history of violations, or other factors.

IMPACTS TO WATER QUALITY FROM AGRICULTURAL DISCHARGES

Impacts to Groundwater – Drinking Water and Human Health

33. Nitrate pollution of drinking water supplies is a critical problem throughout the Central Coast Region. Studies indicate that fertilizer from irrigated agriculture is

the primary source of nitrate pollution of drinking water wells and that significant loading of nitrate continues as a result of agricultural fertilizer practices (Carle, S.F., et al., June 2006).

34. Groundwater pollution from nitrate severely impacts public drinking water supplies in the Central Coast Region. A Department of Water Resources (DWR, 2003) survey of groundwater quality data collected between 1994 and 2000 from 711 public supply wells in the Central Coast Region found that 17 percent of the wells (121 wells) detected a constituent at concentrations above one or more California Department of Public Health (CDPH) drinking water standards or primary maximum contaminant levels (MCLs). Nitrate caused the most frequent MCL exceedances (45 mg/L nitrate as nitrate or 10 mg/L nitrate as nitrogen), with approximately 9 percent of the wells (64 wells) exceeding the drinking water standard for nitrate. According to data reported by the State Water Resources Control Board's Groundwater Ambient Monitoring and Assessment Program (GAMA) GeoTracker website (http://www.waterboards.ca.gov/gama/), recent impacts to public supply wells are greatest in portions of the Salinas Valley (up to 20 percent of wells exceeding MCLs) and Santa Maria (approximately 17 percent) groundwater basins. In the Gilroy-Hollister Groundwater Basin, 12.5 percent of the public supply wells exceed MCLs (data obtained using the GeoTracker DPH Public Supply Well Search Tool for nitrate for wells located in the Gilroy-Hollister groundwater basin. The well data includes Department of Public Health data for well sampling information ranging from 2006 until 2009). CDPH identified over half of the drinking water supply wells as vulnerable to discharges from agricultural-related activities in that basin. This information is readily tracked and evaluated because data are collected on a regular frequency, made publicly available, and public drinking water supplies are regulated by CDPH as required by California law.

35. Groundwater pollution from nitrate severely impacts shallow domestic wells in the Central Coast Region resulting in unsafe drinking water in rural communities. Domestic wells (wells supplying one to several households) are typically drilled in relatively shallow groundwater, and as a result exhibit higher nitrate concentrations than deeper public supply wells. Water quality monitoring of domestic wells is not generally required and water quality information is not readily available; however, based on the available data, the number of domestic wells that exceed the nitrate drinking water standard is likely in the range of hundreds or thousands. Private domestic well water quality is not regulated and rural residents are likely drinking water from these impaired sources without treatment and without knowing the quality of their drinking water.

36. In the northern Salinas Valley, 25 percent of 352 wells sampled (88 wells) had concentrations above the nitrate drinking water standard. In other portions of the Salinas Valley, up to approximately 50 percent of the wells surveyed had

concentrations above the nitrate drinking water standard, with average concentrations nearly double the drinking water standard and the highest concentration of nitrate approximately nine times the drinking water standard (Monterey County Water Resources Agency [MCWRA], 1995). Nitrate exceedances in the Gilroy-Hollister and Pajaro groundwater basins reflect similar severe impairment, as reported by local water agencies/districts for those basins (SCVWD, 2001; SWRCB, 2005; San Benito County Water District, 2007; Kennedy/Jenks Consultants, 2008).

37. Local county and water district reports indicate that in the Pajaro River watershed, the highest recent nitrate concentration (over 650 mg/L nitrate, more than 14 times the drinking water standard) occurred in shallow wells in the eastern San Juan subbasin under intense agricultural production. High values of nitrate concentration in groundwater (greater than 500 mg/L nitrate) have also been reported in the Llagas subbasin and the lower Pajaro coastal aquifer.

38. The costs of groundwater pollution and impacts to beneficial uses caused by irrigated agriculture are transferred to the public. Public drinking water systems expend millions of dollars in treatment and replacement costs and private well owners must invest in expensive treatment options or find new sources. Rural communities, those least able to buy alternative water sources, have few options to replace the contaminated water in their homes. This Order addresses groundwater pollution to ensure protection of beneficial uses and public health.

39. Excessive concentrations of nitrate or nitrite in drinking water are hazardous to human health, especially for infants and pregnant women. The United States Environmental Protection Agency (USEPA) established a nitrate drinking water standard of 45 mg/L nitrate as nitrate (10 mg/L nitrate as nitrogen). While acute health effects from excessive nitrate levels in drinking water are primarily limited to infants (methemoglobinemia or "blue baby syndrome"), research evidence suggests there may be adverse health effects (i.e., increased risk of non-Hodgkin's, diabetes, Parkinson's disease, alzheimers, endrocrine disruption, cancer of the organs) among adults as a result of long-term consumption exposure to nitrate (Sohn, E., 2009; Pelley, J., 2003; Weyer, P., et. al., 2001, Ward, M.H., et. al., 1996).

40. Nitrogen compounds are known to cause cancer. University of Iowa research found that up to 20 percent of ingested nitrate is transformed in the body to nitrite, which can then undergo transformation in the stomach, colon, and bladder to form N-nitroso compounds that are known to cause cancer in a variety of organs in more than 40 animal species, including primates (Weyer, P., et. al., 2001).

41. In many cases, whole communities that rely on groundwater for drinking water are threatened due to nitrate pollution, including the community of San Jerardo and

other rural communities in the Salinas Valley. Local agencies and consumers have reported impacts to human health resulting from nitrate contaminated groundwater likely due to agricultural land uses, and spent significant financial resources to ensure proper drinking water treatment and reliable sources of safe drinking water for the long-term (CCRWQCB, 2009).

42. Current strategies for addressing nitrate in groundwater to achieve levels protective of human health typically include avoidance (abandoning impacted wells or re-drilling to a deeper zone), groundwater treatment to remove nitrate (i.e., dilution using blending, ion exchange, reverse osmosis, biological denitrification, and distillation), or developing additional water supplies (i.e., percolation ponds, surface water pipelines, reservoirs) to dilute nitrate-impacted sources (Lewandowski, A.M., May 2008; Washington State Department of Health, 2005).

43. The costs to treat and clean up existing nitrate pollution to achieve levels that are protective of human health are very expensive to water users (e.g., farmers, municipalities, domestic well users). Research indicates that the cost to remove nitrate from groundwater can range from hundreds of thousands to millions of dollars annually for individual municipal or domestic wells (Burge and Halden, 1999; Lewandowski, May 2008). Wellhead treatment on a region-wide scale is estimated to cost billions of dollars. Similarly, the cost to actively clean up nitrate in groundwater on a region wide scale would also cost billions of dollars, and would be logistically difficult. If the nitrate loading due to agricultural activities is not significantly reduced, these costs are likely to increase significantly.

44. Many public water supply systems are required to provide well-head treatment or blending of drinking water sources, at significant cost, to treat nitrate before delivery to the drinking water consumer due to elevated concentrations of nitrate in groundwater. The community of San Jerardo (rural housing cooperative of primarily low-income farmworker families with approximately 250 residents) initially installed well-head treatment to treat groundwater contaminated with nitrate and other chemicals at significant cost, with on-going monthly treatment costs of approximately $17,000. Monterey County public health officials determined that the community of San Jerardo requires a new drinking water well to ensure safe drinking water quality protective of public health at an approximate cost of more than $4 million. The City of Morro Bay uses drinking water supplies from Morro and Chorro groundwater basins. Study results indicate that agricultural activities in these areas, predominantly over-application of fertilizer, have impacted drinking water supplies resulting in nitrate concentrations more than four times the drinking water standard (Cleath and Associates, 2007). The City of Morro Bay must blend or provide well-head treatment to keep nitrate concentrations at levels safe for drinking water at significant cost (City of Morro Bay, 2006). The City of Santa Maria public supply wells are also impacted by nitrate (in some areas nearly twice

the drinking water standard) and must also blend sources to provide safe drinking water (City of Santa Maria, 2008).

Impacts to Groundwater – Nitrate and Salts

45. Groundwater pollution due to salts is also one of the most significant and critical problems in the Central Coast Region. Agricultural activities are a significant cause of salt pollution (Monterey County Flood Control and Water Conservation District, 1990). Salt increases in irrigated agricultural coastal basins are primarily due to the following:

    a. Seawater intrusion within the coastal basins (e.g., Salinas and Pajaro groundwater basins) caused primarily by excessive agricultural pumping (MCWRA, 2007).
    b. Agricultural pumping/recycling of groundwater that concentrates salts in the aquifers.
    c. Agricultural leaching of salts from the root zone.
    d. The importation of salts into the basin from agricultural soil amendments and domestic/municipal wastewater discharges.

46. Based on the high proportion of groundwater extractions, agricultural pumping of groundwater contributes to saltwater intrusion into the Salinas and Pajaro groundwater basins, which is causing increasing portions of the groundwater basins to be unusable for agriculture and municipal supply (MCWRA, 2008 and Pajaro Valley Water Resource Agency, 2002).

47. Agricultural activities contribute significant loading of nitrates into groundwater from the following sources (Monterey County Flood Control and Water Conservation District, 1988):

    a. Intensive fertilizer applications on permeable soils.
    b. Liquid fertilizer hookups on well pump discharge lines lacking backflow prevention devices.
    c. Groundwater wells that are screened through multiple aquifers, thereby acting as conduits for pollution transport into deeper groundwater.
    d. Spills and/or uncontrolled wash water or runoff from fertilizer handling and storage operations.

48. Agricultural waste discharges contribute to pollution of groundwater basins most vulnerable to waste migration, including major portions of the Santa Maria, Salinas, and Gilroy-Hollister groundwater basins. However, any groundwater basin, including those that are confined (pressured), are susceptible to downward waste migration through improperly constructed, operated (e.g., fertigation or chemigation without backflow prevention), or abandoned wells. Additionally, land with

permeable soils and shallow groundwater are susceptible to downward waste migration. Such areas of groundwater vulnerability often overlap with important recharge areas that serve to replenish drinking water supplies.

49. Agricultural discharges of fertilizer are the main source of nitrate pollution to shallow groundwater based on nitrate loading studies conducted in the Llagas subbasin and the lower Salinas groundwater basin (Carle, S.F., et al., June 2006). In 2007, the California Department of Food and Agriculture (CDFA) reported that approximately 56 million pounds of nitrogen were purchased as fertilizer in Monterey County. A 1990 Monterey County study of nitrate sources leaching to soil and potentially groundwater in Santa Cruz and Monterey Counties indicated that irrigated agriculture contributes approximately 78 percent of the nitrate loading to groundwater in these areas (Monterey County Flood Control and Water Conservation District, November 1990).

50. A groundwater study in the Llagas subbasin indicates that nitrate pollution in groundwater is elevated in the shallow aquifer because it is highly vulnerable due to high recharge rates and rapid transport, and that the dominant source of nitrate is synthetic fertilizers. Groundwater age data in relation to nitrate concentration indicate that the rate of nitrate loading to the shallow aquifer is not yet decreasing in the areas sampled. In areas east of Gilroy, groundwater nitrate concentrations more than double the drinking water standard correspond to younger groundwater ages (less than seven years old and in some cases less than two years old), indicating that the nitrate pollution is due to recent nitrate loading and not legacy farming practices (Moran et al., 2005).

51. The University of California Center for Water Resources (WRC) developed the Nitrate Groundwater Pollution Hazard Index (Nitrate Hazard Index) in 1995. The Nitrate Hazard Index identifies agricultural fields with the highest vulnerability for nitrate pollution to groundwater, based on soil, crop, and irrigation practices. Based on the Nitrate Hazard Index, the following crop types present the greatest risk for nitrate loading to groundwater: Beet, Broccoli, Cabbage, Cauliflower, Celery, Chinese Cabbage (Napa),Collard, Endive, Kale, Leek, Lettuce, Mustard, Onion, Spinach, Strawberry, Pepper, and Parsley.

Impacts to Groundwater – Pesticides

52. The Department of Pesticide Regulation (DPR) has identified two Groundwater Protection Areas that are vulnerable to pesticide contamination in San Luis Obispo County (south of Arroyo Grande, west of Nipomo Mesa, and north of the Santa Maria River) and Monterey County (Salinas area).

53. Based on a 2007 DPR report, pesticide detections in groundwater are rare in the Central Coast region. Of 313 groundwater wells sampled in the Central Coast

region, six wells (1.9%) had pesticide detections in less than two samples (considered unverified detections).

54. A review of DPR data collected from 1984 – 2009 indicates that the three pesticides/pesticide degradates with the highest detection frequency in groundwater were chlorthal-dimethyl and degradates (total), TPA (2,3,5,6-tetrachloroterephthalic acl) and carbon disulfide. Compounds reported by DPR above a preliminary health goal (PHG) or drinking water standard include (by county): ethylene dibromide (2002), atrazine (1993), and dinoseb (1987) Monterey; heptachlor (1989), ethylene dibromide (1989) Santa Barbara; benzene (various dates 1994-2007), 1,2,4-trichlorobenzene (1991) Santa Cruz; ethylene dibromide (1994, 2008, 2009) San Luis Obispo; and 1,1,2,2-tetrachloroethane (1998) Santa Clara.

55. Results from pesticide analyses conducted as part of the Groundwater Ambient Monitoring and Assesment Program (GAMA) studies in the Central Coast region (Kulongoski, 2007; Mathany 2010) indicate a significant presence of pesticides in groundwater. GAMA achieved ultra-low detection levels of between 0.004 and 0.12 micrograms per liter (generally less than .01 micrograms per liter). Out of 54 wells sampled in groundwater basins in the south coast range study unit (bounded by the Santa Lucia and San Luis Ranges, and San Raphael Mountains to the north and east, and the Santa Ynez mountains to the south), 28 percent of the wells had 11 pesticides or pesticide degradates detected in groundwater samples, with the three most abundant detections being deethylatrazine (18.5 percent), atrazine (9.3 percent), and simazine (5.6 percent). Twenty-eight percent of 97 wells sampled in the Monterey Bay and Salinas Valley Basins had pesticide detections, including 18 percent for simazine, 11 percent for deethylatrazine, and 5 percent for atrazine. None of the pesticides detected as part of the GAMA program exceeded any drinking water standard or health-based threshold value.

Impacts to Surface Water

56. The 2010 Clean Water Act Section 303(d) List of Impaired Waterbodies for the Central Coast Region (2010 List of Impaired Waterbodies) identified surface water impairments for approximately 700 waterbodies related to a variety of pollutants (e.g. salts, nutrients, pesticides/toxicity, and sediment/turbidity). Sixty percent of the surface water listings identified agriculture as one of the potential sources of water quality impairment.

57. The impact from agricultural discharges on surface water quality is or has been monitored by various monitoring programs, including:

    a. The Central Coast Water Board's Ambient Monitoring Program: Over the past 10 years, the Central Coast Ambient Monitoring Program (CCAMP) has collected and analyzed water quality data to address 25 conventional water quality parameters from 185 sites across the Central Coast Region to assess surface water quality. To support analysis of conventional water quality data CCAMP has collected bioassessment data from 100 of the 185 sites, water toxicity data from 134 of the 185 sites, and sediment toxicity from 57 of the 185 sites. CCAMP data show widespread toxicity and pollution in agricultural areas.

b. Cooperative Monitoring Program (CMP): Over the last five years, the CMP has focused on assessing agricultural water quality for the 2004 Agricultural Order, and collected and analyzed data for 15 to 20 parameters from 50 sites in multiple watersheds. CMP data show widespread toxicity and pollution in agricultural areas.

58. Data from CCAMP and CMP indicate that surface waterbodies are severely impacted in the lower Salinas and Santa Maria watersheds due to the intensive agricultural activity in these areas, and water quality in these areas are the most severely impaired in the Central Coast Region.

Impacts to Surface Water – Nutrients

59. Nitrate pollution in surface water is widespread in the Central Coast Region, with 46 waterbodies listed as impaired for this pollutant on the 2010 List of Impaired Waterbodies List. Seventy percent of these nitrate listings occur in the three major agricultural watersheds: Salinas area (16 waterbodies), Pajaro River (5 waterbodies) and Santa Maria River (12 waterbodies). Other significant nitrate listings fall in small drainages in areas of intensive agriculture or greenhouse activity along the south coast, including Arroyo Paredon, Franklin Creek, Bell Creek, Los Carneros and Glen Annie creeks (CCRWQCB, 2009a)

60. The California Department of Public Health (CDPH) drinking water standard is 10 mg/L nitrate as N. The drinking water standard is not intended to protect aquatic life and Water Board staff estimates that 1 mg/L nitrate is necessary to protect aquatic life beneficial uses from biostimulation based on an evaluation of CCAMP data (CCRWQCB, 2009b). Water Board staff used this criteria to evaluate surface water quality impairment to aquatic life beneficial uses in the 2010 Impaired Waterbodies List.

61. In a broadly scaled analysis of land uses, nitrate pollution is associated with row crop agriculture. In addition, discharge from even a single agricultural operation can result in adjacent creek concentrations exceeding the drinking water standard and the much lower limits necessary to protect aquatic life. Many heavily urbanized creeks show only slight impacts from nitrate, with most urban impact associated with wastewater discharges. (CCAMP, 2010a).

62. Agricultural discharges result in significant nitrate pollution in the major agricultural areas of the Central Coast Region (CCAMP, 2010a). More than sixty percent of all sites from CCAMP and CMP combined datasets have average nitrate concentrations that exceed the drinking water standard and limits necessary to protect aquatic life (CCAMP, 2010b). Ten percent of all sites have average nitrate concentrations that exceed the drinking water standard by five-fold or more. Some of the most seriously polluted waterbodies include the following:

    a. Tembladero Slough system (including Old Salinas River, Alisal Creek, Alisal Slough, Espinosa Slough, Gabilan Creek and Natividad Creek),
    b. Pajaro River (including Llagas Creek, San Juan Creek, and Furlong Creek),
    c. Lower Salinas River (including Quail Creek, Chualar Creek and Blanco Drain),
    d. Lower Santa Maria River (including Orcutt-Soloman Creek, Green Valley Creek, and Bradley Channel),
    e. Oso Flaco watershed (including Oso Flaco Lake, Oso Flaco Creek, and Little Oso Flaco Creek).

63. Dry season flows decreased over the last five years in some agricultural areas that have large amounts of tailwater runoff. Detailed flow analysis by the CMP showed that 18 of 27 sites in the lower Salinas and Santa Maria watersheds had statistically significant decreases in dry season flow over the first five years of the program. Some sites that show increasing concentrations of nitrate have coincident declining trends in flow, possibly due to reductions in tailwater (CCWQP, 2009a). CCAMP monitoring has detected declining flows at other sites elsewhere in the Region through the end of 2009 (CCAMP, 2010a), likely because of drought.

64. Some statistically significant changes in nitrate concentration are evident in CCAMP and CMP data. Several drainages are improving in water quality in the Santa Barbara area (such as Bell Creek, which supports agricultural activities) and on Pacheco Creek in the Pajaro watershed. However, in some of the most polluted waters (Old Salinas River, Orcutt Creek, Santa Maria River mouth), nitrate concentrations are getting worse (CCAMP, 2010a). In the lower Salinas and Santa Maria watersheds, flow volumes are declining at some sites (CCWQP, 2009a; CCAMP, 2010a).

65. Nitrate concentrations in Oso Flaco Lake exceed the levels that support aquatic life beneficial uses, threatening remaining populations of two endangered plants, marsh sandwort and Gambel's watercress. In 25 water samples taken from Oso Flaco Lake in 2000-2001 and 2007, levels of nitrate/nitrite (as N) averaged 30.5 mg/L with a minimum of 22.0 mg/L and a maximum of 37.1 mg/L (CCAMP, 2010a). Biostimulation in Oso Flaco Lake has caused the rapid and extreme growth of

common wetland species, which are now crowding out sensitive species that have not become similarly vigorous (United States Department of the Interior Fish and Wildlife Service, 2010).

66. Agricultural discharges result in un-ionized ammonia concentrations at levels that are toxic to salmonids at some sites in areas dominated by agricultural activity (USEPA, 1999). The waterbodies where these sites are located are on the 2010 List of Impaired Waterbodies due to un-ionized ammonia, particularly in the lower Salinas and Santa Maria river areas (CCRWQCB, 2009).

Impacts to Surface Water – Toxicity and Pesticides

67. The Basin Plan general objective for toxicity states the following: "All waters shall be maintained free of toxic substances in concentrations which are toxic to, or which produce detrimental physiological responses in human, plant, animal or aquatic life." The Basin Plan general objective for pesticides states the following: "No individual pesticide or combination of pesticides shall reach concentrations that adversely affect beneficial uses. There shall be no increase in pesticide concentrations found in bottom sediments or aquatic life."

68. Based on CCAMP, CMP, and other monitoring data, multiple pesticides and herbicides have been detected in Central Coast surface waterbodies (identified below). The Basin Plan general objective for pesticides states that no individual pesticide or combination of pesticides shall reach concentrations that adversely affect beneficial uses, and <u>no</u> increase in pesticide concentrations shall be found in bottom sediments or aquatic life. Many currently applied pesticides have not been tested for, and staff is only recently aware of data showing several relatively new fungicides (azoxystrobin, pyraclostrobin and boscalid) in fish tissue and sediment of lagoons in the Central Coast Region.[1] This is a violation of the Basin Plan general objective for pesticides. Additional monitoring for individual pesticides is needed to identify changes in pesticide loading and to identify concentrations of toxic and/or bioaccumulating substances not previously identified.

2,4-D	esfenvalerate	oryzalin
Alachlor	ethalfluralin	oxadiazon
Aldicarb	ethoprop	oxamyl
Atrazine	fenamiphos	oxyfluorfen

[1] "Watershed-scale Evaluation of Agricultural BMP Effectiveness in Protecting Critical Coastal Habitats: Final Report on the Status of Three Central California Estuaries" (Anderson et al, 2010). http://www.ccamp.org/ccamp/documents/EstuariesFinalReport022311.pdf.

azinphos-methyl		
Azoxystrobin	fenoxycarb	paraquat dichloride
Benefin	fenpropathrin	pendimethalin
bentazon, sodium salt	fipronil	permethrin
Bifenthrin		
Boscalid	glyphosate	phorate
Bromacil	hexazinone	phosmet
bromoxynil octanoate	hydramethylnon	prodiamine
butylate	imidacloprid	prometon
Carbaryl	lambda cyhalothrin	prometryn
Carbofuran	linuron	propanil
Chlorpyrifos	malathion	propargite
chlorthal-dimethyl	MCPA	propiconazole
cycloate	MCPA, dimethylamine salt	propoxur
Cyfluthrin	metalaxyl	propyzamide
		Pyriproxyfen
Cypermethrin	methidathion	pyraclostrobin
DDVP	methiocarb	S.S.S-tributyl phosphorotrithioate
Deltamethrin	methomyl	siduron
Diazinon	methyl isothiocyanate	simazine
Dicamba	methyl parathion	tebuthiuron
Dicofol	metolachlor	terbuthylazine
Dimethoate	metribuzin	tetrachlorvinphos
Disulfoton	molinate	thiobencarb
Diuron	naled	triallate
Endosulfan	napropamide	triclopyr
EPTC	norflurazon	trifluralin

69. Multiple studies, including some using Toxicity Identification Evaluations (TIEs), have shown that organophosphate pesticides and pyrethroid pesticides in Central Coast waters are likely causing toxicity to fish and invertebrate test organisms (CCAMP, 2010a, CCWQP, 2008a; CCWQP, 2009; CCWQP, 2010a; CCWQP, 2010d (in draft); Hunt et al., 2003, Anderson, et al. 2003; Anderson et al., 2006b. This is a violation of the Basin Plan general objective for toxicity.

70. Agricultural use rates of pesticides in the Central Coast Region and associated toxicity is among the highest in the State. In a statewide study of four agricultural areas conducted by the Department of Pesticide Regulation (DPR), the Salinas study area had the highest percent of surface water sites with pyrethroid pesticides detected (85 percent), the highest percent of sites that exceeded levels expected

to be toxic and lethal to aquatic life (42 percent), and the highest rate (by three-fold) of active ingredients applied (113 lbs/acre) (Starner, et al. 2006).

71. Agriculture-related toxicity studies conducted on the Central Coast since 1999 indicated that toxicity resulting from agricultural waste discharges of pesticides has caused declining aquatic insect and macroinvertebrate populations in Central Coast streams (Anderson et al., 2003; Anderson et al., 2006a; Anderson et al., 2006b; Anderson et al., 2010). This is a violation of the Basin Plan general objective for toxicity.

72. The breakdown products of organophosphate pesticides are more toxic to amphibians than are the products themselves (Sparling and Fellers, 2007).

73. The lower Salinas and Santa Maria areas have more overall water column invertebrate toxicity than other parts of the Central Coast Region, with much of the toxicity explained by elevated diazinon and chlorpyrifos concentrations (CCAMP, 2010a, CCWQP, 2008a; CCWQP, 2009; Hunt et al., 2003, Anderson, et al. 2003; Anderson et al., 2006a). Some agricultural drains have shown toxicity nearly every time the drains are sampled (CCAMP, 2010a).

74. Fish and sand crabs from the Salinas, Pajaro, and Santa Maria estuaries had detectable levels of currently applied fungicides, herbicides, and legacy pesticides like DDT based on a recently completed study of these central coast lagoons Anderson et al. (2010). Multiple samples from the Santa Maria Estuary, the most impacted of the three estuaries, also contained chlorpyrifos, diazinon, and malathion (organophosphate pesticides) and bifenthrin and cyfluthrin (pyrethroid pesticides). Department of Public Health human consumption guideline levels for these pesticides in fish tissue are not available. This is the first study in this Region documenting these currently applied pesticides in fish tissue. The Basin Plan requires that "there shall be no increase in pesticide concentrations found in bottom sediments or **aquatic life** (emphasis added)".

75. The National Oceanic Atmospheric Administration National Marine Fisheries Service (NMFS) issued a Biological Opinion that concluded that US EPA's registration of pesticides containing chlorpyrifos, diazinon, and malathion is likely to jeopardize the continued existence of 27 endangered and threatened Pacific salmonids and is likely to destroy or adversely modify designated critical habitat for 25 threatened and endangered salmonids because of adverse effects on salmonid prey and water quality in freshwater rearing, spawning, migration, and foraging areas (NMFS, 2008)

76. Three court-ordered injunctions impose limitations on pesticide use (including chlorpyrifos, diazinon, and malathion) within certain proximity of waterbodies to protect endangered species (DPR, 2010).

77. Creek bottom sediments are most consistently toxic in the lower Salinas and Santa Maria watersheds, areas dominated by intensive agricultural activity. Seventy percent of sites sampled for sediment in the Central Coast region have been toxic at least once (although sites selected for sediment toxicity sampling typically represent higher risk areas) (CCAMP, 2010a).

78. A CMP follow-up study on sediment toxicity (CCWQP, 2010d, in draft) showed pyrethroid pesticides to be the most prevalent and severe source of toxicity to sediments. Santa Maria area sites averaged 7.5 toxic units (TUs) from pyrethroid pesticides and 1.3 TUs from chlorpyrifos. One TU is sufficient to kill 50% of the test organisms in a toxicity test). All Santa Maria area sites were toxic to test organisms. Second highest pesticide levels were found in Salinas tributaries and the Salinas Reclamation canal, averaging 5.4 TUs pyrethroids and 0.8 TUs chlorpyrifos. Organochlorine pesticides were present, but not at levels sufficient to cause toxicity.

79. Peer-reviewed research has also shown pyrethroid pesticides are a major source of sediment toxicity in agricultural areas of the Central Coast Region (Ng et al., 2008; Anderson et al., 2006a, Phillips et al., 2006; Starner et al., 2006).

80. Agricultural sources of metals are particulate emissions, irrigation water, pesticides, biosolids, animal manure, and fertilizer applied directly to the soil (Chang et al, 2004). Metals, including arsenic, boron, cadmium, copper, lead, nickel, and zinc are common active ingredients in many pesticides (Fishel, 2008; Nesheim, 2002; Holmgren, 1998; Reigert and Roberts, 1999). Metals can be present in subsurface drainage discharge and may be associated with sediment in tailwater discharge. Some phosphate fertilizers contain cadmium, which can lead to an increase in the concentration of cadmium in soil. Past studies have found soils containing high concentrations of cadmium and lead in major vegetable production areas of the Salinas Valley (Chang et al, 2004; Page et al, 1987; USEPA, 1978; Jelinek and Braude, 1978).

81. The Basin Plan contains the following general objective for Phenols, 0.1 mg/L or 100 µg/L. Phenols are components or breakdown products of a number of pesticide formulations, including 2,4 D, MCPA, carbaryl, propoxur, carbofuran, and fenthion (Crespin, et al., 2001, Agrawal, et al., 1999). Phenolic compounds can cause odor and taste problems in fish tissue, some are directly toxic to aquatic life, and some are gaining increasing notice as endocrine disruptors (e.g., bisphenol A and nonylphenol). The original water quality standards were developed in response to concerns about odor and taste and direct toxicity.

82. One phenolic compound of known concern in Central Coast waters is nonylphenol. Agricultural sources of nonylphenol and the related nonylphenol

ethoxylates include pesticide products as “inert” ingredients and as adjuvants added by the pesticide user. Adjuvant ingredients are not reported in California's Pesticide Use Database. Adjuvants enhance a chemical’s effect. Nonylphenol and related compounds are used as surfactants to make the pesticide product more potent and effective (Cserhati, 1995). Nonylphenol and its ethoxylates are acutely toxic to a wide variety of animals, including aquatic invertebrates and fish. In some cases, the nonylphenol is more toxic to aquatic species than the pesticide itself (National Research Council of Canada, 1982). Concern exists about these adverse effects of nonylphenol and its ethoxylates increases because these compounds also bioaccumulate in algae, mussels, shrimp, fish, and birds (Ahel et al, 1993; Ekelund (1990).

83. The San Luis Obispo Science and Ecosystem Alliance (SLOSEA) at California Polytechnic State University has found nonylphenol in elevated concentrations in fish tissue and has linked the occurrence to gonadal abnormalities and liver damage in fish in Morro Bay and other Central Coast locations. The Basin Plan standard of 100 µg/L for phenols is relatively protective for direct toxicity of nonylphenol to rainbow trout, which have an LC50 (lethal concentration impacting 50% of test organisms) of 194 µg/L. However, this limit is not protective for endocrine disruption purposes, which for rainbow trout is estimated at an EC50 (estrogenic concentration impacting 50% of test organisms) of 14.14 µg/L (Lech, 1996). Regardless of the limitations of the Basin Plan standard, it is important to assess this chemical in areas that are heavily influenced by agricultural activity.

Impacts to Surface Water – Turbidity and Temperature

84. Turbidity is a cloudy condition in water due to suspended silt or organic matter. Waters that exceed 25 nephalometric turbidity units (NTUs) can reduce feeding ability in trout (Sigler et al., 1984). Elevated turbidity during the dry season is an important measure of discharge across bare soil, and thus can serve as an indicator of systems with heavy irrigation runoff to surface waters.

85. The Basin Plan requires that “Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses” (CCRWQCB, 1994).

86. Most CCAMP sites outside of agricultural areas have a median turbidity level less than 5 NTUs (CCAMP, 2010a). Many sampling sites that include significant agricultural discharge have turbidity levels that exceed 100 NTUs as a median value (CCAMP, 2010a).

87. Agricultural discharges cause and contribute to sustained turbidity throughout the dry season at many sampling sites dominated by agricultural activities. Resulting turbidity greatly exceeds levels that impact the ability of salmonids to feed. Many

of these sites are located in the lower Santa Maria and Salinas-Tembladero watersheds. The CMP detected some increasing trends in turbidity on the main stem of the Salinas River (CCRWQCB, 2009a; CCAMP, 2010a; CCWQP, 2009a).

88. Agricultural discharges and vegetation removal along riparian areas cause and contribute to water temperatures that exceed levels that are necessary to support salmonids at some sites in areas dominated by agricultural activity. Several of these sites are in major river corridors that provide rearing and/or migration habitat for salmonids. A good example of this is Orcutt Creek (CCAMP, 2010a), where upstream shaded areas are cooler than downstream exposed areas, in spite of lower upstream flows. Tailwater discharge and removal of riparian vegetation in downstream areas cause temperatures to rise above levels safe for trout. Several locations impacted by temperature are in major river corridors that provide rearing and/or migration habitat for salmonids. These include the Salinas, Santa Maria, and Santa Ynez rivers (CCAMP, 2010a).

89. Biological sampling shows that benthic biota are impaired in the lower Salinas and Santa Maria watersheds, and also shows that several measures of habitat quality, such as in-stream substrate and canopy cover, are poor compared to the upper watersheds and to other high quality streams in the Central Coast Region (CCWQP, 2009b; CCWQP, 2009c, CCWQP, 2009d; CCWQP, 2009e; CCAMP, 2010b)

90. Agricultural land use practices, such as removal of vegetation and stream channelization, and discharges from agricultural fields, can cause the deposition of fine sediment and sand over stream bottom substrate (Waters, 1995). This problem is especially prevalent in areas dominated by agricultural activity (lower Salinas and Santa Maria rivers) (CCWQP, 2009b; CCWQP, 2009c, CCWQP, 2009d; CCWQP, 2009e; CCAMP, 2010b). This deposition of fine sediment and sand in streams causes major degradation of aquatic life beneficial uses by eliminating pools and by clogging gravel where fish eggs, larvae, and benthic invertebrates that serve as a food source typically live (CCAMP, 2010b; Waters, 1995). Effective erosion control and sediment control management practices include but are not limited to cover crops, filter strips, and furrow alignment to reduce runoff quantity and velocity, hold fine particles in place, and increase filtration to minimize the impacts to water quality (USEPA, 1991).

91. Orchards, vineyards, and row crops have the greatest erosion rates in irrigated agriculture, especially those that are managed with bare soil between tree or vine rows (ANR, 2006). A vegetative filter strip offers one way to control erosion rates and discharge of sediment rather than letting it be carried off site in drainage water. A vegetative filter strip is an area of vegetation that is planted intentionally to help remove sediment and other pollutants from runoff water (Dillaha et al., 1989) Vegetative filter strips intercept surface water runoff and trap as much as 75 to 100

percent of the water's sediment. They capture nutrients in runoff, both through plant uptake through adsorption to soil particles. They promote degradation and transformation of pollutants into less-toxic forms, and they remove over 60% of certain pathogens from the runoff. (ANR, 2006).

Impacts to the Marine Environment

92. The marine environment in the Central Coast Region is impacted by runoff from irrigated agriculture and other sources. Legacy pesticides have impacted the marine environment and are still found in sediment and tissue at levels of concern today (CCLEAN, 2007; Miller et al., 2007; Dugan, 2005, BPTCP, 1998). Currently applied pesticides are persistent in the aquatic environment, but initial testing has not found them in offshore areas of Monterey Bay (CCAMP, 2010b).

93. Two Marine Protected Areas (MPAs), Elkhorn Slough and Moro Cojo Slough, are heavily impacted by agricultural chemicals and activities in the vicinity. The Elkhorn Slough and Moro Cojo Slough MPAs are at very high to extremely high risk for additional degradation of beneficial uses. Other MPAs that are relatively near shore in agricultural areas are at medium risk for degradation of beneficial uses; these include the South Santa Ynez River MPA, and the two Monterey Bay MPAs. Other MPAs that are not near agricultural areas are at medium to low risk from agricultural discharges (CCAMP, 2010b).

94. Nitrate loading from the Pajaro and Salinas Rivers to Monterey Bay has been found to be a potential driver of plankton blooms during certain times of year. Research shows a clear onshore to offshore gradient in nitrate load influence from rivers, and also shows overall increasing trends in loading from rivers, whereas nitrate loading from upwelling shows no trends (Lane, 2009; Lane et al., in review). Using infrared remote sensing, Monterey Bay Aquarium Research Institute researchers have documented bloom initiation immediately following "first flush" events just offshore Moss Landing and Pajaro River discharges, that then evolved into very large red tides that killed many sea birds (Ryan, 2009; Jessup et al., 2009). These bloom initiation events were documented in 2007 and 2008.

Impacts to Aquatic Habitat and Riparian and Wetland Areas

95. Riparian and wetland areas play an important role in protecting several of the beneficial uses designated in the Basin Plan. Agricultural activities have degraded, and threaten to degrade, these beneficial uses related to aquatic habitat, which include, but are not limited to:

   a. Ground Water Recharge;
   b. Fresh Water Replenishment;
   c. Warm Fresh Water Habitat;

d. Cold Fresh Water Habitat;
e. Inland Saline Water Habitat;
f. Estuarine Habitat;
g. Marine Habitat;
h. Wildlife Habitat;
i. Preservation of Biological Habitats of Special Significance;
j. Rare, Threatened or Endangered Species;
k. Migration of Aquatic Organisms;
l. Spawning, Reproduction and/or Early Development;
m. Areas of Special Biological Significance;

96. The Basin Plan contains requirements to protect aquatic habitat, including, but not limited to, Chapter 2, Section II Water Quality Objectives to Protect Beneficial Uses, and Chapter 5, Page V-13, V.G. Erosion and Sedimentation: A filter strip of appropriate width, and consisting of undisturbed soil and riparian vegetation or its equivalent, shall be maintained, wherever possible, between significant land disturbance activities and watercourses, lakes, bays, estuaries, marshes, and other water bodies. For construction activities, minimum width of the filter strip shall be thirty feet, wherever possible.

97. Riparian and wetland areas play an important role in achieving several water quality objectives established to protect specific beneficial uses. These include, but are not limited to, those water quality objectives related to natural receiving water temperature, dissolved oxygen, suspended sediment load, settleable material concentrations, chemical constituents, and turbidity.

98. The 2004 Agricultural Order required protection of beneficial uses including aquatic and wildlife habitat. This Order includes that requirement to achieve protection of aquatic life beneficial uses and to address water quality degradation that has occurred, in part, as a result of encroachment by agricultural land uses on riparian and wetland areas.

99. In particular, seasonal and daily water temperatures are strongly influenced by the amount of solar radiation reaching the stream surface, which is influenced by riparian vegetation (Naiman, 1992; Pierce's Disease/Riparian Habitat Workgroup (PDRHW), 2000.). Removal of vegetative canopy along surface waters threatens maintenance of temperature water quality objectives, which in turn negatively affects dissolved oxygen related water quality objectives, which in turn negatively affects the food web (PDRHW, 2000).

100. Riparian and wetland areas function to retain and recycle nutrients (National Research Council (NRC), 2002; Fisher and Acreman, 2004), thereby reducing nutrient loading directly to surface water or groundwater. Riparian and wetland areas trap and filter sediment and other wastes contained in agricultural runoff

(NRC, 2002; Flosi et al., 1998; PDRHW, 2000; Palone and Todd,1998), and reduce turbidity (USEPA, 2009). Riparian and wetland areas temper physical hydrologic functions, protecting aquatic habitat by dissipating stream energy and temporarily allowing the storage of floodwaters (Palone and Todd, 1998), and by maintaining surface water flow during dry periods (California Department of Water Resources, 2003). Riparian and wetland areas regulate water temperature and dissolved oxygen, which must be maintained within healthy ranges to protect aquatic life (PDRHW, 2000). In the absence of human alteration, riparian areas stabilize banks and supply woody debris (NRC 2002), having a positive influence on channel complexity and in-stream habitat features for fish and other aquatic organisms (California Department of Fish and Game 2003).

101. Riparian areas are critical to the quality of in-stream habitat. Riparian vegetation provides woody debris, shade, food, nutrients and habitat important for fish, amphibians and aquatic insects (California Department of Fish and Game 2003). Riparian areas help to sustain broadly based food webs that help support a diverse assemblage of wildlife (NRC, 2002). More than 225 species of birds, mammals, reptiles, and amphibians depend on California's riparian habitats (Riparian Habitat Joint Venture, 2004).

102. Riparian vegetation provides important temperature regulation for instream resources. In shaded corridors of the Central Coast region, temperatures typically stay under 20 degrees Celsius or 68 degrees F (within optimum temperature ranges for salmonids), but can rapidly increase above 20 degrees Celsius when vegetation is removed. Orcutt Creek in the lower Santa Maria watershed is an example where upstream shaded areas remain cooler than downstream exposed areas, in spite of lower upstream flows (CCAMP, 2010a).

103. Land management and conservation agencies describe three vegetated zones within a riparian buffer that can provide water quality protection (NRCS, 2006; Welsch, 1991, Tjaden and Weber). These zones are described below:
   a. Zone 1 – The goal for this zone is to control temperature and turbidity discharges by establishing a mix of trees and shrubs that provide shade and streambank stability. A mix of native woody species that vary from large tree species as they mature to understory trees and shrubs will provide canopy cover and shading next to the water.
   b. Zone 2 – The goal for this zone is to establish a mix of trees and shrubs that will absorb and treat waterborne nutrients and other pollutants and allow water to infiltrate into the soil.
   c. Zone 3 – The goal for this zone is to act as a transitional zone between cropland and zones 1 and 2, serving to slow flows, disperse flows out into more diffuse, sheet flow, and promote sediment deposition. The use of stiff multi-stemmed grasses and forbs are preferred and will help disperse concentrated flows.

104. CCAMP and CMP bioassessment data show that streams in areas of heavy agricultural use are typically in poor condition with respect to benthic community health and that habitat in these areas is often poorly shaded, lacking woody vegetation, and heavily dominated by fine sediment. Heavily sedimented stream bottoms can result from the immediate discharge of sediment from nearby fields, the loss of stable, vegetated stream bank habitat, the channelization of streams and consequent loss of floodplain, and from upstream sources.

105. Up to approximately 43 percent of the federally threatened and endangered species rely directly or indirectly on wetlands for their survival (United States Environmental Protection Agency, 2008). Of all the states, California has the greatest number of at-risk animal species (15) and, by far, the greatest number of at-risk plant species (104) occurring within isolated wetlands (Comer et al., 2005).

106. California has lost an estimated 91 percent of its historic wetland acreage, the highest loss rate of any state. Similarly, California has lost between 85 and 98 percent of its historic riparian areas (State Water Resources Control Board, 2008). Landowners and operators of agricultural operations historically removed riparian and wetland areas to plant cultivated crops (Braatne et al., 1996; Riparian Habitat Joint Venture, 2004).

107. The California Wetlands Conservation Policy (Executive Order W-59-93), also known as "the No Net Loss Policy," adopted by Governor Wilson in 1993, established the State's intent to develop and adopt a policy framework and strategy to protect California's unique wetland ecosystems. One of the goals of this policy is to ensure no overall net loss and achieve a long-term net gain in the quantity, quality, and permanence of wetlands acreage and values in California in a manner that fosters creativity, stewardship and respect for private property.

108. Real and/or perceived incompatible demands between food safety and environmental protection are a major issue in the Central Coast Region. Technical Assistance Providers have reported that growers have removed vegetated management practices intended to protect water quality (in some cases, after receiving substantial public funds to install vegetated management practices).

109. According to a spring 2007 survey by the Resource Conservation District of Monterey County (RCDMC), 19 percent of 181 respondents said that their buyers or auditors had suggested they remove non-crop vegetation from their ranches to prevent pollution from pathogens such as the O157:H7 bacteria. In response to pressures by auditors and/or buyers, approximately 15 percent of all growers surveyed indicated that they had removed or discontinued use of previously adopted management practices used for water quality protection. Grassed waterways, filter or buffer strips, and trees or shrubs were among the management

practices removed (RCDMC, 2007). According to a follow-up spring 2009 survey by RCDMC, growers are being told by their auditors and/or buyers that wetland or riparian plants are a risk to food safety (RCDMC, 2009). To assist in the co-management of water quality protection and food safety, the RCDMC has developed a handbook of agricultural conservation practices, photos, and descriptions with food safety considerations (RCDMC, 2009).

110. The Food Safety Modernization Act (FSMA) was signed into law on January 4, 2011 giving the U.S Food and Drug Administration (FDA) a mandate to pursue a farm to table system that is based on science and addresses food safety hazards. The law requires FDA to apply sound science to any requirements that might impact wildlife and wildlife habitat on and near farms, and take into consideration conservation and environmental practice standards and policies.

111. Riparian vegetation and vegetated buffer zones are critically important to prevent the transport of sediment and bacteria, which may include the downstream transport of O157:H7 bacteria. Tate et al. (2006) tested vegetated buffers on cattle grazing lands and found that they are a very effective way to reduce inputs of waterborne E. coli into surface waters. Data indicates that the major source of O157:H7 bacteria are cattle, not wildlife (RCDMC, 2006). In many agricultural areas of the Central Coast Region, cattle operations are located upstream of irrigated agricultural fields. Therefore, the removal of riparian and wetland vegetation and their buffer zones increases the transport of pathogens such as O157:H7 and the risk of food contamination. The removal of riparian and wetland vegetation for food safety purposes is not warranted, is not supported by the literature, and may increase the risk of food contamination.

112. Agriculture near surface waterbodies can lead to removal or reduction of riparian vegetation and the impairment of its ecological functions (ANR, 2007). Once riparian vegetation is removed, it no longer serves to shade water, provide food for aquatic organisms, maintain stream banks, provide a source of large woody debris, or slow or filter runoff to streams. The result is degraded water quality and fish habitat (ANR, 2007). For these reasons, maintenance of riparian vegetation is a critical element of any type of land use (ANR, 2007).

113. Buffer strips are areas of vegetation left beside a stream or lake to protect against land use impacts (ANR, 2007). Whether or not harvesting is permitted within the buffer strip, well-designed and managed buffers can contribute significantly to the maintenance of aquatic and riparian habitat and the control of pollution. Riparian buffer strips protect aquatic and riparian plants and animals from upland sources of pollution by trapping or filtering sediments, nutrients, and chemicals from forestry, agricultural and residential activities. (ANR, 2007).

114. Vegetated riparian areas provide greater environmental value than unvegetated floodplains or cropped fields. Riparian forests provide as much as 40 times the water storage of a cropped field and 15 times that of grass turf (Palone and Todd, 1998). Agricultural floodplains are approximately 80 to 150 percent more erodible than riparian forest floodplains (Micheli et al., 2004) and riparian forest floodplains serve a valuable function by trapping sediment from agricultural fields (National Resource Council, 2002; Flosi and others, 1998; PDRHW 2000; Palone and Todd 1998).

115. Riparian and wetland areas are an effective tool in improving agricultural land management. Wide riparian areas act as buffers to debris that may wash onto fields during floods, thereby offsetting damage to agricultural fields and improving water quality (Flosi et al., 1998; PDRHW, 2000).

116. Exotic plant species exclude native riparian and wetland vegetation by out-competing native species for habitat. Additionally, exotic plants do not support the same diversity of wildlife native to riparian forests, often use large amounts of water, and can exist as monocultural stands of grass. Grass habitat is very different from the complex habitat structure provided by a diversity of riparian trees and shrubs, and results in habitat changes that affect the aquatic based food web (California Department of Fish and Game, 2003).

MANAGEMENT PRACTICE IMPLEMENTATION

117. Commercial agriculture is an intensive use of land. Relatively sophisticated agronomic and engineering approaches are available and necessary to minimize the discharge of waste from irrigated lands, including sediment, nutrients, and pesticides that impact water quality and beneficial uses of waters of the State. Traditionally, conservation practices available to Dischargers were developed for irrigation efficiency or for erosion control, and not necessarily for water quality protection. To achieve water quality protection and improvement, Dischargers are responsible for selecting and effectively implementing management strategies to resolve priority water quality problems associated with the specific operation and receiving water, utilize proper management practice design and maintenance, and implement effectiveness monitoring.

118. The Central Coast Water Board recognizes efforts to maximize water quality improvement using innovative and effective local or regional treatment strategies and it is the Central Coast Water Board’s intent to provide flexibility in the implementation of this Order to encourage discharger participation in such efforts. The Central Coast Water Board will evaluate proposed local or regional treatment strategies based upon the anticipated effectiveness, time schedule for implementation, and proposed verification monitoring and reporting to measure progress towards water quality improvement and compliance with this Order.

119. The Central Coast Water Board recognizes efforts to improve recharge conditions and restore groundwater recharge function that have been lost due to urbanization and agricultural development. Managed aquifer recharge (MAR) has been successfully applied in areas of the Central Coast region, improving both water supply and water quality in the basin (Racz et al., in review). Water applied to percolation basins for MAR projects often have a high quality relative to that in underlying aquifers in many locations, despite exceedances of water quality standards. Recharging this water into the ground is important for improving and maintaining water quality in critical aquifers. In addition, considerable improvement in water quality can be achieved during percolation of surface water because of beneficial microbial and filtering processes that occur (Schmidt et al., in review). The Central Coast Water Board encourages MAR efforts, which will result in improving both water supply and water quality.

120. Dischargers are responsible for implementing management measures to achieve water quality improvement, including practices and projects at the scale of a single farm, or cooperatively among multiple farms in a watershed or sub watershed.

121. The Farm Plan is an effective tool to identify the management practices that have been or will be implemented to protect and improve water quality in compliance with this Order. Elements of the Farm Plan include irrigation management, pesticide management, nutrient management, salinity management, sediment and erosion control, and aquatic habitat protection. Farm Plans also contain a schedule for implementation of practices and an evaluation of progress in achieving water quality improvement. The development and implementation of Farm Plans was a requirement of the 2004 Agricultural Order. This Order renews the requirement to prepare the Farm Plan, and adds new conditions requiring each Discharger to verify the effective implementation of management practices focused on resolving water quality issues and for a subset of Dischargers considered a higher threat to water quality to conduct individual discharge monitoring to verify the effective implementation of management practices.

122. Dischargers can significantly reduce the potential impact from agricultural discharges by the effective implementation of management practices identified in Farm Plans focused on priority water quality issues related to the specific operation and watershed.

123. Individual on-farm water quality monitoring is critical to adaptively manage and effectively implement practices to protect water quality. The data and reporting will inform the Discharger, the Water Board, and the public regarding compliance with this Order, and increases the potential success in adapting management practices to address priority water quality issues. Dischargers participating in on-farm water quality monitoring have reported, in some cases, significant reduction or

elimination of their discharge of waste through effective and adaptive management practice implementation.

124. Agricultural discharges, especially surface irrigation runoff, have the potential to transport sediments and associated waste constituents that exceed water quality standards. Minimizing irrigation runoff is an effective way to minimize and/or eliminate agricultural discharges of waste to waters of the State.

125. Agricultural water quality research identifies the importance of minimizing the amount of water runoff coming from farms. Irrigation runoff occurs when the application rate of the irrigation system exceeds the infiltration rate of the soil due to numerous factors, including poor irrigation efficiency. The percent of applied water lost to runoff may start off low, and increase towards the end of longer irrigations, or with frequent irrigation where soil is saturated. Fields with soils susceptible to low infiltration rates may lose 5 percent to 30 percent or more of their applied water to runoff.

126. Applying fertilizer, soil amendments, or agricultural products directly through an irrigation system (fertigation) increases nitrate levels in irrigation water. Runoff from fertigations is likely to be extremely high in nitrate concentrations. Agricultural research conducted in the Pajaro Valley and Salinas Valley watersheds has identified nitrate values in agricultural tailwater and drainage ditches exceeding 100 mg/L nitrate as N in some cases (more than ten times the drinking water standard, and likely more than 100 times the level necessary to protect aquatic life) (Anderson, 2003).

127. Agricultural studies document the common over-application of fertilizers, and fertilizer and animal manure are the most dominant and widespread nitrate sources to groundwater (Harter, 2009; Kitchen, 2008; Lawrence Livermore National Lab GAMA Studies Llagas subbasin, 2005). Effective irrigation and nutrient management practices to reduce the concentration of nutrients in irrigation runoff, deep percolation, and stormwater include but are not limited to, irrigation efficiency to reduce runoff and deep percolation, nutrient budgeting to optimize fertilizer application and eliminate excessive nutrient applications, and techniques to trap nutrients between crop growing seasons and during intense periods of rainfall.

128. Agricultural studies and practices demonstrate that minimizing the production of polluted tailwater through irrigation efficiency and nutrient management practices and keeping runoff from leaving the farm is cost effective (Meals, 1994). Improving irrigation water application according to real time soil moisture data has resulted in some of the lowest concentrations of nutrients in percolating waters, confirming that irrigation efficiency is a key factor in reducing leaching of nutrients (United Water Conservation District, 2007).

129. Nitrate in water leaving subsurface drain ("tile") systems often exceeds drinking water standards and contributes to low-oxygen in marine environments. Denitrification, including the use of wood-chip bioreactor treatment systems, is an effective method of removing nitrate from soil water before it enters subsurface drains (Jaynes, et al., 2006; Starrett, 2009).

130. Agricultural land uses can disrupt the natural vegetation-soil cycles and biota diversity, keeping the soil surface unprotected and vulnerable to erosive forces (wind and rain), which increases the amount of sediments dispersed and transported from agricultural lands into surface water (USEPA, 2003).

131. Agricultural mechanization and tillage of soil and land for bed preparation, crop maintenance and pest control, can destroy the soil structure and degrade the land, which increases the amount of sediment and associated waste constituents discharged into surface water (Fawcett, 2005).

132. Managing uncropped areas, minimizing and protecting bare soil and heavy use areas and unpaved road from concentrated flows of water, and implementing practices to detain or filter sediment and runoff before it leaves agricultural operations are effective ways to reduce soil erosion and capture sediment before it enters waterways, where it can cause water quality impairments downstream (ANR Publications 8124 and 8071).

133. Stormwater runoff from irrigated lands often results in significant erosion and the discharge of sediment, nutrients, and pesticides. Effective erosion control and sediment control management practices include but are not limited to cover crops, filter strips, and furrow alignment to reduce runoff quantity and velocity, hold fine particles in place, and increase filtration to minimize the impacts to water quality (USEPA, 1991). Crops grown using impervious plastic can be particularly problematic as they often result in significantly increased irrigation runoff volumes and velocities in agricultural furrows and ditches that may drain to waters of the State.

134. Education and technical assistance is an important tool in advancing the implementation of new effective management practices that protect and enhance water quality.

135. There are many technical resources available to the agricultural industry to assist farmers in pollution prevention and addressing water quality problems associated with irrigated agriculture. The United States Department of Agriculture - Natural Resources Conservation Service (NRCS), Resource Conservation Districts (RCD), and University of California Cooperative Extension (UCCE) provide non-regulatory technical services and research to promote conservation and address natural resource problems. There are also many non-profit agricultural and commodity-

specific organizations and initiatives that promote sustainable agriculture, and provide education and technical support. Private consulting companies and individual professionals working in the field of environmental and engineering sciences, investigations, site remediation and corrective actions, treatment system design, sampling, and reporting are available to assist the agricultural industry in water quality improvement and achieving compliance with this Order.

136. The State and Regional Water Boards have made over $600 Million of public grant funds available to address agricultural water quality issues from approximately 2000 – 2011. These funds came from Bond Propositions 13, 40, 50, and 84, and addressed a myriad of water quality projects, watershed protection, and nonpoint source pollution control throughout California. In addition, the State Water Board, in coordination with USEPA, also allocates approximately $4.5 Million per year in 319(h) program funding to address nonpoint source pollution. The amount of Water Board public grant funds recently awarded in the Central Coast Region for agricultural related projects is more than $55 Million.

AGRICULTURAL REGULATORY PROGRAM IMPLEMENTATION

137. The Central Coast Water Board is maximizing regulatory effectiveness by identifying and prioritizing actions that address the most significant agricultural water quality problems in the Central Coast Region, including nitrate in groundwater from discharge related to excess fertilizer application, the discharge of waste in agricultural tailwater, surface water toxicity resulting from pesticides, surface water nutrients from fertilizer, increasing salinity, sediment discharge, and degradation of aquatic habitat.

138. The Central Coast Water Board is addressing priority agricultural water quality issues, on a watershed basis in coordination with other Water Board programs and efforts, focused in the most intensive agricultural areas of the region including the Salinas, Pajaro, and Santa Maria watersheds. In addition, Central Coast Water Board staff will assess and track progress towards specific measures of water quality improvement, and adapt to the feedback the tracking provides.

139. The Central Coast Water Board will evaluate compliance of individual Dischargers with the terms and conditions of this Order based on enrollment information, threat of water quality impairment, content of technical reports (including Annual Compliance Document, Farm Plan, Irrigation and Nutrient Management Plan, and Water Quality Buffer Plan), prioritized inspections, and water quality monitoring data. Failure to comply with enrollment requirements may result in enforcement action for individual landowners and operators. In addition to the determination of noncompliance and water quality impairment, the Central Coast Water Board will enforce the conditions of this Order in a manner similar to enforcement of WDRs

and consistent with the State Water Board's Enforcement Policy, focusing on the highest priority water quality issues and most severely impaired waters.

140. The Central Coast Water Board will consider the history of compliance and violations and progress made toward compliance and water quality improvement demonstrated by individual Dischargers when determining potential enforcement actions. In some cases, the Central Coast Water Board may terminate coverage under this Order and require the Discharger to submit a ROWD and comply with the Water Code pursuant to individual WDRs.

PART B. RELEVANT PLANS, POLICIES, AND REGULATIONS

Water Quality Control Plan

The *Water Quality Control Plan for the Central Coast Region* (Basin Plan) was adopted by the Central Coast Water Board in 1975 and is periodically revised. Tables 1A and 1B include a summary of Narrative and Numeric Water Quality Objectives. The Basin Plan is available by contacting the Central Coast Water Board at (805) 549-3147 or by visiting the Central Coast Water Board's website at: http://www.waterboards.ca.gov/centralcoast/publications_forms/publications/basin_plan/

Other Relevant Plans, Policies, and Regulations

State Water Resources Control Board, Resolution No. 68-16, *Statement of Policy with Respect to Maintaining High Quality of Waters in California,* October 1968.

State Water Resources Control Board, *Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California*, June 1972.

State Water Resources Control Board, Resolution No. 74-43, *Water Quality Control Policy for the Enclosed Bays and Estuaries of California*, May 1974.

State Water Resources Control Board, Resolution No. 88-63, *Sources of Drinking Water Policy*, May 1988. Amended February 1, 2006.

State Water Resources Control Board, *Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program,* May 2004.

State Water Resources Control Board, Resolution No. 2004-0063, *Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List,* December 13, 2004.

State Water Resources Control Board, *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (SIP)*, February 2005

"State Water Resources Control Board, Resolution No. 2008-0070, *Water Quality Control Plan for Enclosed Bays and Estuaries - Part 1 Sediment Quality,* August 25, 2009.

State Water Resources Control Board, *Water Quality Control Plan for Ocean Waters of California (CA Ocean Plan),* September 2009.

State Water Resources Control Board, Resolution No. 2009-0011, *Recycled Water Policy*, May 20,2010.

State Water Resources Control Board, *Water Quality Enforcement Policy,* May 20, 2010.

US EPA, *National Toxics Rule*, 40 CFR 131.36, 57 FR 60848, December 1992.

US EPA, *California Toxics Rule*, 40 CFR 131.38, 65 FR 31682, May 2000.

Table 1A. Narrative and Numeric Water Quality Objectives for Surface Water.

SURFACE WATER QUALITY OBJECTIVE *(Source of WQO-Page in Basin Plan)* (Objectives are numeric unless labeled "narrative")	**BENEFICIAL USE**
TOXICITY	
Toxicity *(BPGO, III-4)* *Narrative Objective:* All waters shall be maintained free of toxic substances in concentrations which are toxic to, or which produce detrimental physiological responses in, human, plant, animal, or aquatic life. *Indicators of Narrative Objective:* Chemical concentrations in excess of toxic levels for aquatic life including but not limited to the following: Chlorpyrifos 0.025 ug/L Diazinon 0.14 ug/L *(Source: Sipmann and Finlayson 2000)*	All Surface Waters
TOXICANTS	
Nutrients	
Ammonia, Total (N) *(BPSO, Table 3.3)* >30 mg/L NH4-N	AGR
Ammonia, **Un-ionized** *(BPGO, III-4)* 0.025 mg/L NH3 as N	All Surface Waters
Nitrate *(a. BPSO, Table 3-2* *b. BPSO, Table 3-3)* a. 10 mg/L NO3-N b. >30 mg/L NO3-N	a. MUN b. AGR
Organics	
Chemical Constituents *(BPSO, III-5 and* *Table 3-2)* Waters shall not contain concentrations of chemical constituents in excess of the limits specified in California Code of Regulations, Title 22, Article 4, Chapter 15,	MUN

SURFACE WATER QUALITY OBJECTIVE *(Source of WQO-Page in Basin Plan)* (Objectives are numeric unless labeled "narrative")	**BENEFICIAL USE**
Section 64435, Tables 2 and 3 as listed in Table 3-2.	
Chemical Constituents *(BPSO, III-5 and Table 3-3)* Waters shall not contain concentrations of chemical constituents in amounts which adversely affect the agricultural beneficial use. Interpretation of adverse effect shall be as derived from the University of California Agricultural Extension Service guidelines provided in Table 3-3. In addition, waters used for irrigation and livestock watering shall not exceed concentrations for those chemicals listed in Table 3-4	AGR
Chemical Constituents *(BPSO, III-10, Table 3-5, Table 3-6)* Waters shall not contain concentrations of chemical constituents known to be deleterious to fish or wildlife in excess of the limits listed in Table 3-5 or Table 3-6.	COLD, WARM, MAR
Oil and Grease *(BPGO, III-3)* *Narrative Objective:* Waters shall not contain oils, greases, waxes, or other similar materials in concentrations that result in a visible film or coating on the surface of the water or on objects in the water, that cause nuisance, or that otherwise adversely affect beneficial uses.	All Surface Waters
Organic Chemicals *(BPSO, III-5 and Table 3-1)* All inland surface waters, enclosed bays, and estuaries shall not contain concentrations of organic chemicals in excess of the limiting concentrations set forth in California Code of Regulations, Title 22, Chapter 15, Article 5.5, Section 64444.5, Table 5 and listed in Table 3-1.	MUN
Other Organics *(BPGO, III-3)* **Phenol** *(BPSO, III-5)* Waters shall not contain organic substances in concentrations greater than the following:	All Surface Waters

SURFACE WATER QUALITY OBJECTIVE *(Source of WQO-Page in Basin Plan)* (Objectives are numeric unless labeled "narrative")	**BENEFICIAL USE**
Methylene Blue Activated Substances < 0.2 mg/L Phenols < 0.1 mg/L Phenol (MUN) ≤ 1.0 µg/L PCBs < 0.3 µg/L Phthalate Esters < 0.002 µg/L	
Metals	
Chromium *(BOSP, III-12)* ≤ 0.01 mg/L	SHELL
Cadmium *(BPGO, III-11)* ≤ 0.03 mg/L in hard water or ≤.0.004 mg/L in soft water (Hard water is defined as water exceeding 100 mg/L $CaCO_3$).	COLD, WARM
Chromium *(BPGO, III-11)* ≤ 0.05 mg/L	COLD, WARM
Copper *(BPGO, III-11)* ≤ 0.03 mg/L in hard water or ≤.0.01 mg/L in soft water (Hard water is defined as water exceeding 100 mg/L $CaCO_3$).	COLD, WARM
Lead *(BPGO, III-11)* ≤ 0.03 mg/L	COLD, WARM
Mercury *(BPGO, III-11)* ≤ 0.0002 mg/L	COLD, WARM
Nickel *(BPGO, III-11)* ≤ 0.4 mg/L in hard water or	COLD, WARM

SURFACE WATER QUALITY OBJECTIVE *(Source of WQO-Page in Basin Plan)* (Objectives are numeric unless labeled "narrative")	**BENEFICIAL USE**
≤.0.1 mg/L in soft water (Hard water is defined as water exceeding 100 mg/L $CaCO_3$).	
Zinc *(BPGO, III-11)* ≤ 0.2 mg/L in hard water or ≤.0.004 mg/L in soft water (Hard water is defined as water exceeding 100 mg/L $CaCO_3$).	COLD, WARM
CONVENTIONALS	
Biostimulatory Substances *(BPGO, III-3)* *Narrative Objective:* Waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses. *Indicators of Narrative Objective:* Indicators of biostimulation include chlorophyll-a, dissolved oxygen, phosphorous, and nitrate. *(Source: Central Coast Water Board. April 2009. Central Coast Ambient Monitoring Program Technical Paper: Interpreting Narrative Objectives for Biostimulatory Substances Using the Technical Approach for Developing California Nutrient Numeric Endpoints)*	All Surface Waters
Boron *(BPSO, III-13)* Waterbody specific. Median values, shown in Table 3-7 for surface waters. Sub-Basins Objectives range from 0.2 – 0.5 mg/L.	Specific Surface Waters
Chloride *(BPSO, III-13)* Waterbody specific. Median values, shown in Table 3-7 for surface waters. Sub-Basins Objectives range from 150-1400 mg/L.	Specific Surface Waters
Color *(BPGO, III-3)* Waters shall be free of coloration that causes nuisance or adversely affects beneficial uses. Coloration attributable to materials of waste origin shall not be greater than 15 units or 10 percent above natural background color, whichever is	All Surface Waters

SURFACE WATER QUALITY OBJECTIVE *(Source of WQO-Page in Basin Plan)* (Objectives are numeric unless labeled "narrative")	**BENEFICIAL USE**
greater.	
Conductivity *(BPSO, III-8, Table 3-3)* >3.0 mmho/cm	AGR
Dissolved Oxygen (DO) *(BPGO, III-2)* Mean annual DO $\geq$ 7.0 mg/L Minimum DO $\geq$ 5.0 mg/L	All Ocean Waters
Dissolved Oxygen *(BPGO, III-4)* For waters not mentioned by a specific beneficial use: DO $\geq$ 5.0 mg/L DO Median values $\geq$ 85 percent saturation	All Surface Waters
Dissolved Oxygen *(BPSO, III-10)* DO $\geq$ 7.0 mg/L	COLD, SPWN
Dissolved Oxygen *(BPSO, III-10)* DO $\geq$ 5.0 mg/L	WARM
Floating Material *(BPGO, III-3)* *Narrative Objective:* Waters shall not contain floating material, including solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect beneficial uses.	All Surface Waters
pH *(BPSO, III-10)* The pH value shall not be depressed below 7.0 nor above 8.5. Changes in normal ambient pH levels shall not exceed 0.5 in fresh waters.	COLD, WARM,
pH *(BPSO, III-10)*	MAR

SURFACE WATER QUALITY OBJECTIVE *(Source of WQO-Page in Basin Plan)* (Objectives are numeric unless labeled "narrative")	**BENEFICIAL USE**
The pH value shall not be depressed below 7.0 or raised above 8.5[2]. Changes in normal ambient pH levels shall not exceed 0.2 units.	
pH *(BPSO, III-5)* The pH value shall not be depressed below 6.5 nor above 8.3.	MUN, REC-1, REC-2, AGR
Settleable Material *(BPGO, III-3)* *Narrative Objective:* Waters shall not contain settleable material in concentrations that result in deposition of material that causes nuisance or adversely affects beneficial uses.	All Surface Waters
Sediment *(BPGO, III-3)* *Narrative Criteria:* The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.	All Surface Waters
Sodium *(BPSO, III-13)* Waterbody specific. Median values, shown in Table 3-7 for surface waters. Sub-Basins Objectives range from 20-250 mg/L.	
Sulfate *(BPSO, III-13)* Waterbody specific. Median values, shown in Table 3-7 for surface waters. Sub-Basins Objectives range from 10-700 mg/L.	
Suspended Material *(BPGO, III-3)* *Narrative Criteria:* Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.	All Surface Waters
Taste and Odor *(BPGO, III-3)*	All Surface Waters

SURFACE WATER QUALITY OBJECTIVE *(Source of WQO-Page in Basin Plan)* (Objectives are numeric unless labeled "narrative")	**BENEFICIAL USE**
Narrative Criteria: Waters shall not contain taste or odor-producing substances in concentrations that impart undesirable tastes or odors to fish flesh or other edible products of aquatic origin, that cause nuisance, or that adversely affect beneficial uses.	
Temperature *(BPGO, III-3)* *Narrative Criteria:* Natural receiving water temperature of intrastate waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Board that such alteration in temperature does not adversely affect beneficial uses.	All Surface Waters
Temperature *(BPGO, III-4)* *Narrative Objective:* Natural receiving water temperature of intrastate waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Board that such alteration in temperature does not adversely affect beneficial uses. *a) Indicators of Narrative Objective for COLD Habitat:* **Coho** December - April 48-54 ºF 7-DAM[3] 56-58 ºF 1-DAM May – November 57-63 ºF 7-DAM 68-70 ºF 1-DAM **Steelhead** December - April 55-57 ºF 7-DAM 56-58 ºF 1-DAM May – November 56-63 ºF 7-DAM 70-73 ºF 1-DAM *(Source: Hicks 2000)* *b) Indicators of Narrative Objective for WARM Habitat:* **<u>Stickleback</u>** Upper optimal limit = 75 ºF (This temperature is also the low end of the upper	All Surface Waters a) COLD b) WARM

SURFACE WATER QUALITY OBJECTIVE *(Source of WQO-Page in Basin Plan)* (Objectives are numeric unless labeled "narrative")	**BENEFICIAL USE**
lethal limit for steelhead) *(Source: Moyle 1976)* Note: 7-DAM refers to the rolling arithmetic average of seven consecutive daily maximum temperatures. 1-DAM refers to the highest daily maximum temperature.	
Temperature *(BPSO, III-10)* At no time or place shall the temperature be increased by more than 5^{o}F above natural receiving water temperature.	COLD, WARM
Total Dissolved Solids (TDS) *(BPSO, III-13)* Waterbody specific. Median values, shown in Table 3-7 for surface waters. Sub-Basins Objectives range from 10-250 mg/L.	
Turbidity *(BPGO, III-3)* *Narrative Objective:* Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. *Indicators of Narrative Objective:* Turbidity greater than 25 NTU's causes reduction in juvenile salmonid growth due to interference with their ability to find food. *(Source: Central Coast Water Board. April 2009. Clean Water Act Sections 305(b) and 303(d) Integrated Report for the Central Coast Region; Sigler et al. 1984. Effects of chronic turbidity on density and growth of steelheads and coho salmon. Transactions of the American Fisheries Society 113:142-150)*	All Surface Waters
PATHOGEN INDICATORS	
Fecal Coliform *(BOSP,III-5)* Log mean 200 MPN/100mL. Max 400 MPN/100mL.	REC-1
Fecal Coliform *(BOSP,III-10)*	REC-2

SURFACE WATER QUALITY OBJECTIVE *(Source of WQO-Page in Basin Plan)* (Objectives are numeric unless labeled "narrative")	**BENEFICIAL USE**
Log mean 2000 MPN/100mL. Max 4000 MPN/100mL.	
E. coli *(USEPA)* Max 235 MPN/100 mL	REC-1
Total Coliform *(BOSP,III-12)* Median $\leq$ 70/100 MPN/100mL Max 230 MPN/100 mL	SHELL

Table 1B. Narrative and Numeric Water Quality Objectives for Groundwater.

GROUNDWATER QUALITY OBJECTIVE *(Source of WQO-Page in BP)* (Objectives are numeric unless labeled "narrative")	**BENEFICIAL USE**
TOXICANTS	
Chemical Constituents *(BPSO, III-14)* Groundwaters shall not contain concentrations of chemical constituents in excess of federal or state drinking water standards.	MUN
Chemical Constituents *(BPSO, III-14 and Tables 3-3 and 3-4)* Groundwaters shall not contain concentrations of chemical constituents in amounts that adversely affect such beneficial use. Interpretation of adverse effect shall be as derived from the University of California Agricultural Extension Service guidelines provided in Table 3-3. In addition, water used for irrigation and livestock watering shall not exceed the concentrations for those chemicals listed in Table 3-4.	AGR
Total Nitrogen *(BPSO, III-15 and Table 3-8)* Groundwater Basin Objectives for Median values range from	Specific Groundwater Basins

GROUNDWATER QUALITY OBJECTIVE *(Source of WQO-Page in BP)* (Objectives are numeric unless labeled "narrative")	**BENEFICIAL USE**
1-10 mg/L as N.	
CONVENTIONALS	
Total Dissolved Solids (TDS) *(BPSO, III-15)* Groundwater Basin Objectives for median values range from 100-1500 mg/L TDS.	Specific Groundwater Basins
Chloride (Cl) *(BPSO, III-15)* Groundwater Basin Objectives for median values range from 20-430 mg/L Cl.	Specific Groundwater Basins
Sulfate (SO_4) *(BPSO, III-15)* Groundwater Basin Objectives for median values range from 10-1025 mg/L SO_4.	Specific Groundwater Basins
Boron (B) *(BPSO, III-15)* Groundwater Basin Objectives for median values range from 0.1-2.8 mg/L B.	Specific Groundwater Basins
Sodium (Na) *(BPSO, III-15)* Groundwater Basin Objectives for median values range from 10-730 mg/L.	Specific Groundwater Basins

Acronyms:
BP = Basin Plan or Water Quality Control Plan for the Central Coast Region
BPGO = Basin Plan General Objective
BPSO = Basin Plan Specific Objective related to a designated beneficial use
TMDL = Specific Objective related to an adopted Total Maximum Daily Load
WDR = Waste Discharge Requirements
SB = State Board established guideline
USEPA = US Environmental Protection Agency
CCAMP = Central Coast Ambient Monitoring Program
SWAMP = Surface Water Ambient Monitoring Program

MCL = Maximum Contaminant Level, California drinking water standards set forth in California Code of Regulations, Title 22.
NTU = Nephelometric Turbidity Unit
mg/L = milligram/Liter
MPN = Most Probable Number

PART C. DEFINITIONS

The following definitions apply to Order No. R3-2012-0011and MRP Order No. R3-2012-0011-01, MRP Order No. R3-2012-0011-02, and MRP Order No. R3-2012-0011-03 as related to discharges of waste from irrigated lands. The terms are arranged in alphabetical order. All other terms not explicitly defined for the purposes of this Order and Monitoring and Reporting Program shall have the same definitions as prescribed by California Water Code Division 7 or are explained within the Order or the MRP documents.

1. Anti-degradation. The State Water Board established a policy to maintain high quality waters of the State - Resolution 68-16 "*Statement of Policy with Respect to Maintaining High Quality Waters in California*." Resolution 68-16 requires existing high quality water to be maintained until it has been demonstrated 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 water, and will not result in water quality less than that prescribed in the policies. Regional Water Boards are required to ensure compliance with Resolution 68-16. The Central Coast Water Board must require discharges to be subject to *best practicable treatment or control* of the discharge necessary to avoid pollution or nuisance and to maintain the highest water quality consistent with maximum benefit to the people of the State. Resolution 68-16 has been approved by the USEPA to be consistent with the federal anti-degradation policy.

2. Aquatic Habitat. The physical, chemical, and biological components and functions of streams and lakes, including riparian areas and wetlands and their buffer zones.

3. Aquifer. A geologic formation, group of formations, or part of a formation capable of yielding a significant amount of groundwater to wells or springs. (see also uppermost aquifer).

4. Back flow Prevention. Back flow prevention devices are installed at the well or pump to prevent contamination of groundwater or surface water when fertilizers, pesticides, fumigants, or other chemicals are applied through an irrigation system. Back flow prevention devices used to comply with this Order must be those approved by USEPA, DPR, CDPH, or the local public health or water agency.

5. Basin Plan. The Basin Plan is the Central Coast's Region Water Quality Control Plan. The Basin Plan describes how the quality of the surface and groundwater in the Central Coast Region should be managed to provide the highest water quality reasonably possible. The Basin Plan includes beneficial uses, water quality objectives, and a program of implementation.

6. Beneficial Uses. The Basin Plan establishes the beneficial uses to be protected in the Central Coast Region. Beneficial uses for surface water and groundwater are divided into twenty-four standard categories identified below. The following beneficial uses have been identified in waterbodies within the Region:

- agricultural supply (AGR)
- aquaculture (AQUA)
- areas of special biological significance (ASBS)
- cold freshwater habitat (COLD)
- commercial and sportfishing (COMM)
- estuarine habitat (EST)
- freshwater replenishment (FRESH)
- groundwater recharge (GWR)
- hydropower generation (POW)
- industrial process supply (PRO)
- industrial service supply (IND)
- inland saline water habitat (SAL)
- marine habitat (MAR)
- municipal and domestic supply (MUN)
- migration of aquatic organisms (MIGR)
- navigation (NAV)
- non-contact recreation (REC2)
- preservation of biological habitats of special significance (BIOL)
- rare, threatened or endangered species (RARE)
- shellfish harvesting (SHELL
- spawning, reproduction, and development (SPWN)
- warm freshwater habitat (WARM)
- water contact recreation (REC1)
- wildlife habitat (WILD)

7. Chemigation. The application of pesticides, fertilizers, fumigants or other chemicals through an irrigation system.

8. Commercial. Irrigated lands producing commercial crops are those operations that have one or more of the following characteristics:

   a. The landowner or operator holds a current Operator Identification Number/Permit Number for pesticide use reporting;
   b. The crop is sold, including but not limited to (1) an industry cooperative, (2) harvest crew/company, or (3) a direct marketing location, such as Certified Farmers Markets;.
   c. The federal Department of Treasury Internal Revenue Service form 1040 Schedule F Profit or Loss from Farming is used to file federal taxes.

9. Concentration. The relative amount of a substance mixed with another substance. An example is 5 parts per million (ppm) of nitrogen in water or 5 mg/L.

10. Crop Types with High Potential to Discharge Nitrogen to Groundwater. Based on the Groundwater Pollution Nitrate Hazard Index developed by the University of California Division of Agriculture and Natural Resources (UCANR), the following crop types present the greatest risk for nitrogen loading to groundwater: beet, broccoli, cabbage, cauliflower, celery, Chinese cabbage (napa),collard, endive, kale, leek, lettuce (leaf and head), mustard, onion (dry and green), spinach, strawberry, pepper (fruiting), and parsley.

11. Discharge. A release of a waste to waters of the State, either directly to surface waters or through percolation to groundwater. Wastes from irrigated agriculture include but are not limited to earthen materials (soil, silt, sand, clay, and rock), inorganic materials (metals, plastics, salts, boron, selenium, potassium, nitrogen, phosphorus, etc.) and organic materials such as pesticides.

12. Discharger. The owner and operator of irrigated lands that discharge or have the potential to discharge waste that could directly or indirectly reach waters of the State and affect the quality of any surface water or groundwater. See also Responsible Party.

13. Discharges of Waste from Irrigated Lands. Surface water and groundwater discharges, such as irrigation return flows, tailwater, drainage water, subsurface drainage generated by irrigating crop land or by installing and operating drainage systems to lower the water table below irrigated lands (tile drains), stormwater runoff flowing from irrigated lands, stormwater runoff conveyed in channels or canals resulting from the discharge from irrigated lands, runoff resulting from frost control, and/or operational spills containing waste.

14. Ephemeral Stream. A channel that holds water during and immediately after rain events.

15. Erosion. The wearing away of land surface by wind or water, intensified by land-clearing practices related to farming, residential or industrial development, road building, or logging.

16. Erosion and Sediment Control Practices. Practices used to prevent and reduce the amount of soil and sediment entering surface water in order to protect or improve water quality.

17. Environmental Justice. Providing equal and fair access to a healthy environment for communities of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies; and proactive efforts to take into account existing

environmental injustices and to protect from new or additional environmental hazards and inequitable environmental burdens;

18. Exceedance. A reading using a field instrument or a detection by a California State-certified analytical laboratory where the detected result is above an applicable water quality standard for the parameter or constituent. For toxicity tests, an exceedance is a result that is statistically lower than the control sample test result.

19. Farm or Ranch. For the purposes of this Order, a tract of land where commercial crops are produced or normally would have been produced. Individual farms/ranches typically have a similar farm/ranch manager, operator or landowner(s) and are categorized by farm size, primary output(s), and/or geographic location.

20. Farm Water Quality Management Plan (Farm Plan). The Farm Plan is a document that contains, at a minimum, identification of management practices that are being or will be implemented to protect and improve water quality by addressing irrigation management, pesticide management, nutrient management, salinity management, sediment and erosion control, and aquatic habitat protection. Farm Plans also contain a schedule for the effective implementation of management practices and verification monitoring to determine compliance with the requirements of this Order (schedules, milestones, effluent limits, etc.). Consistent with the Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands adopted by the Board in July 2004 (Order No. R3-2004-0117), this Order requires Dischargers to develop and implement a Farm Plan focused on the priority water quality issues associated with a specific operation and the priority water quality issues associated with a specific watershed or subwatershed.

21. Fertigation. The application of fertilizers through an irrigation system.

22. Freshwater Habitat. Uses of water that support cold or warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

23. Groundwater. The supply of water found beneath the earth's surface, usually in aquifers, which supply wells and springs.

24. Groundwater Protection Practices. Management practices designed to reduce or eliminate transport of nitrogen, pesticides, and other waste constituents into groundwater.

25. Integrated Pest Management Program (IPM). A pest management strategy that focuses on long-term prevention or suppression of pest problems through a

combination of techniques such as encouraging biological control, use of resistant varieties, or adoption of alternative cultivating, pruning, or fertilizing practices or modification of habitat to make it incompatible with pest development. Pesticides are used only when careful field monitoring indicates they are needed according to pre-established guidelines or treatment thresholds.

26. Intermittent Stream. A stream that holds water during wet portions of the year.

27. Irrigated Lands. For the purpose of this Order, irrigated lands include lands where water is applied for the purpose of producing commercial crops and include, but are not limited to, land planted to row, vineyard, field and tree crops as well as commercial nurseries, nursery stock production and greenhouse operations with soil floors, that do not have point-source type discharges, and are not currently operating under individual Waste Discharge Requirements (WDRs). Lands that are planted to commercial crops that are not yet marketable, such as vineyards and tree crops, must also obtain coverage under this Order.

28. Irrigation. Applying water to land areas to supply the water and nutrient needs of plants.

29. Irrigation Management Practices. Management practices designed to improve irrigation efficiency and reduce the amount of irrigation return flow or tailwater, and associated degradation or pollution of surface and groundwater caused by discharges of waste associated with irrigated lands.

30. Irrigation Runoff or Return Flow. Surface and subsurface water that leaves the field following application of irrigation water. See also, Tailwater.

31. Irrigation System Distribution Uniformity. Irrigation System Distribution Uniformity is a measure of how uniformly irrigation water is applied to the cropping area, expressed as a percentage. A nonuniform distribution can deprive portions of the crop of sufficient irrigation water, and can result in the excessive irrigation leading to water-logging, plant injury, salinization, irrigation runoff and transport of chemicals to surface water and groundwater.

32. Landowner. An individual or entity who has legal ownership of a parcel(s) of land. For the purposes of this Order, the landowner is responsible for ensuring compliance with this Order and for any discharge of waste occurring on or from the property.

33. Limited Resource Farmer. A Limited Resource Farmer is defined by the U.S. Dept. of Agriculture (USDA) as:

a. A person with direct or indirect gross farm sales not more than the current indexed value (determined by USDA) in each of the previous 2 years, and

b. A person who has a total household income at or below the national poverty level for a family of four, or less than 50 percent of county median household income in each of the previous 2 years.

The USDA's Limited Resource Farmer "Self Determination Tool" is available at: http://www.lrftool.sc.egov.usda.gov/DeterminationTool.aspx?fyYear=2012

34. Load. The concentration or mass of a substance discharged over a given amount of time, for example 10 mg/day or 5 Kg/day, respectively.

35. Monitoring. Sampling and analysis of receiving water quality conditions, discharge water quality, aquatic habitat conditions, effectiveness of management practices, and other factors that may affect water quality conditions to determine compliance with this Order or other regulatory requirements. Monitoring includes but is not limited to: surface water or groundwater sampling, on-farm water quality monitoring undertaken in connection with agricultural activities, monitoring to identify short and long-term trends in in-stream water quality or discharges from sites, inspections of operations, management practice implementation and effectiveness monitoring, maintenance of on-site records and management practice reporting.

36. Nitrate Hazard Index. In 1995, the University of California Center for Water Resources (WRC) developed the Nitrate Groundwater Pollution Hazard Index (Nitrate Hazard Index) (Wu, 2005). The purpose of the Nitrate Hazard Index is to identify agricultural fields with the highest vulnerability for nitrate pollution to groundwater, based on soil, crop, and irrigation practices. The hazard index number can range from 1 through 80 with the hazard increasing with increasing hazard index number. The WRC states that an index number greater than 20 indicates greater risk for nitrate pollution to groundwater and should receive careful attention.

http://ucanr.org/sites/wrc/Programs/Water_Quality/Nitrate_Groundwater_Pollution_Hazard_Index/

37. Nitrate Loading Risk Factor. A measure of the relative risk of loading nitrate to groundwater based on the following criteria a) Nitrate Hazard Index Rating by Crop Type, b) Irrigation System Type, and c) Irrigation Water Nitrate Concentration.

38. Non-point Source Pollution (NPS). Diffuse pollution sources that are generally not subject to NPDES permitting. The wastes are generally carried off the land by runoff. Common non-point sources are activities associated with agriculture, timber harvest, certain mining, dams, and saltwater intrusion.

39. Non-Point Source Management Measures. To combat NPS pollution, the State Water Board NPS Program adopted management measures as goals for the reduction of polluted runoff generated from five major categories, including agriculture. Management measures address the following components for agriculture: Erosion and sediment control; facility wastewater and runoff from confined animal facilities; nutrient management; pesticide management; irrigation water management; grazing management, and groundwater protection.

40. Non-Point Source Management Practices. Methods or practices selected by entities managing land and water to achieve the most effective, practical means of preventing or reducing pollution from diffuse sources, such as wastes carried off the landscape via urban runoff, excessive hill, slope or streambed and bank erosion, etc. Management Practices include, but are not limited to, structural and nonstructural controls and operation and maintenance procedures. Management Practices can be applied before, during, and after pollution-causing activities to prevent, reduce, or eliminate the introduction of wastes into receiving waters.

41. Nutrient. Any substance assimilated by living things that promotes growth.

42. Nutrient Management Practices. Management practices designed to reduce the nutrient loss from agricultural lands, which occur through edge-of-field runoff or leaching from the root zone.

43. Operator. Person responsible for or otherwise directing farming operations in decisions that may result in a discharge of waste to surface water or groundwater, including, but not limited to, a farm/ranch manager, lessee or sub-lessee. The operator is responsible for ensuring compliance with this Order and for any discharge of waste occurring on or from the operation.

44. Operation. A distinct farming business, generally characterized by the form of business organization, such as a sole proprietorship, partnership, corporation, and/or cooperative. A farming operation may be associated with one to many individual farms/ranches.

45. Operational Spill. Irrigation water that is diverted from a source such as an irrigation well or river, but is discharged without being delivered to or used on an individual field.

46. Perennial Stream. A stream that holds water throughout the year.

47. Pesticide Management Practices. Management practices designed to reduce or eliminate pesticide runoff into surface water and groundwater.

48. Point Source. Any discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel or other floating craft from which wastes are or may be discharged.

49. Pollutant. The man-made or man-induced alteration of the chemical, physical, biological, and radiological integrity of water, including dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water.

50. Public Water System. A system for the provision of water for human consumption through pipes or other constructed conveyances that has 15 or more service connections or regularly serves at least 25 individuals daily at least 60 days out of the year. A public water system includes the following: (1) Any collection, treatment, storage, and distribution facilities under control of the operator of the system which are used primarily in connection with the system; (2) Any collection or pretreatment storage facilities not under, the control of the operator that are used primarily in connection, with the system; (3) Any water system that treats water on behalf of one or more public water systems for the purpose of rendering it safe for human consumption.

51. Quality of the Water. The “chemical, physical, biological, bacteriological, radiological, and other properties and characteristics of water which affect its use” as defined in the California Water Code Sec. 13050(g).

52. Receiving Waters. Surface waters or groundwater that receive or have the potential to receive discharges of waste from irrigated lands.

53. Requirements of Applicable Water Quality Control Plans. Water quality objectives, prohibitions, Total Maximum Daily Load (TMDL) Implementation Plans, or other requirements contained in the Basin Plan, as adopted by the Central Coast Water Board and approved according to applicable law.

54. Responsible Party. The owner and operator of irrigated lands that discharge or have the potential to discharge waste that could directly or indirectly reach waters of the State and affect the quality of any surface water or groundwater. See also Discharger.

55. Riparian Area. Vegetation affected by the surface water or groundwater of adjacent perennial or intermittent streams, lakes or other waterbodies. Vegetation species are distinctly different from adjacent areas or are similar to adjacent areas

but exhibit more vigorous or robust growth forms indicative of increased soil moisture. Riparian areas may also include floodplains. Floodplains are critical areas for retaining floodwaters, allowing for sediment deposition and the natural movement of riparian areas, as well as space for colonization of new riparian and wetland vegetation necessary due to natural meandering. (Dall et. al. 1997, p.3)

56. Source of Drinking Water. Any water designated as municipal or domestic supply (MUN) in a Regional Water Board Basin Plan and/or as defined in SWRCB Resolution No. 88-63.

57. Stormwater. Stormwater runoff, snow melt runoff, and surface runoff and drainage, as defined in 40 CFR 122.26(b)(13).

58. Subsurface Drainage. Water generated by installing drainage systems to lower the water table below irrigated lands. The drainage can be generated by subsurface drainage systems, deep open drainage ditches or drainage wells.

59. Surface Runoff. Precipitation, snow melt, or irrigation water in excess of what can infiltrate the soil surface and be stored in small surface depressions; a major transporter of non-point source wastes in rivers, streams, and lakes.

60. Tailwater. Runoff of irrigation water from the lower end of an irrigated field. See also, Irrigation Runoff or Return Flow.

61. Tile Drains. Subsurface drainage which removes excess water from the soil profile, usually through a network of perforated tile tubes installed 2 to 4 feet below the soil surface. This lowers the water table to the depth of the tile over the course of several days. Drain tiles allow excess water to leave the field. Once the water table has been lowered to the elevation of the tiles, no more water flows through the tiles. The Central Coast Water Board anticipates evaluating longer timeframes necessary to address tile-drain discharges, for inclusion in a subsequent Agricultural Order.

62. Total Maximum Daily Load (TMDL). The condition of an impaired surface waterbody (on the List of Impaired Waterbodies) that limits the amount of pollution that can enter the waterbody without adversely affecting its beneficial uses, usually expressed as a concentration (e.g., mg/L) or mass (e.g., kg); TMDLs are proportionally allocated among dischargers to the impaired surface waterbody.

63. Total Nitrogen Applied. Total nitrogen applied includes nitrogen in any product, form or concentration) including, but not limited to, organic and inorganic fertilizers, slow release products, compost, compost teas, manure, extracts, nitrogen present in the soil, and nitrate in irrigation water; Reported in units of nitrogen per crop, per acre for each farm/ranch or nitrate loading risk unit;

64. Uppermost Aquifer. The geologic formation nearest the natural ground surface that is an aquifer, as well as lower aquifers that are hydraulically interconnected with this aquifer.

65. Waste. "Includes sewage and any and all other waste substances, liquid, solid, gaseous, or radioactive, associated with human habitation, or of human or animal origin, or from any producing, manufacturing, or processing operation, including waste placed within containers of whatever nature prior to, and for purposes of, disposal" as defined in the California Water Code Sec. 13050(d). "Waste" includes irrigation return flows and drainage water from agricultural operations containing materials not present prior to use. Waste from irrigated agriculture includes *earthen materials* (such as soil, silt, sand, clay, rock), *inorganic materials* (such as metals, salts, boron, selenium, potassium, nitrogen, phosphorus), and *organic materials* such as pesticides.

66. Water Quality Buffer. A water quality protection zone surrounding perennial or intermittent channels, including adjacent wetlands (as defined by the Clean Water Act), with riparian vegetation and/or riparian functions that support beneficial uses and protect water quality.

67. Water Quality Control. The "regulation of any activity or factor which may affect the quality of the waters of the State and includes the prevention and correction of water pollution and nuisance" as defined in the California Water Code Sec. 13050(i).

68. Water Quality Criteria. Levels of water quality required under Sec. 303(c) of the Clean Water Act that are expected to render a body of water suitable for its designated uses. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, fish production, or industrial processes. The *California Toxics Rule* adopted by USEPA in April 2000, sets numeric Water Quality Criteria for non-ocean waters of California for a number of pollutants. See also, Water Quality Objectives.

69. Water Quality Objectives. "Limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specified area," as defined in Sec. 13050(h) of the California Water Code. Water Quality Objectives may be either numerical or narrative and serve as Water Quality Criteria for purposes of Section 303 of the Clean Water Act. Specific Water Quality Objectives relevant to this Order are identified in this Appendix A in Tables 1A and 1B.

70. Water Quality Standard. Provisions of State or Federal law that consist of the beneficial designated uses or uses of a waterbody, the numeric and narrative

water quality criteria that are necessary to protect the use or uses of that particular waterbody, and an anti-degradation statement. Water quality standards includes water quality objectives in the Central Coast Water Board's Basin Plan, water quality criteria in the California Toxics Rule and National Toxics Rule adopted by USEPA, and/or water quality objectives in other applicable State Water Board plans and policies. For groundwater with the beneficial use of municipal or domestic water supply, the applicable drinking water standards are those established by the United States Environmental Protection Agency (USEPA) or California Department of Public Health (CDPH), whichever is more stringent. Under Sec. 303 of the Clean Water Act, each State is required to adopt water quality standards.

71. Waters of the State. "Any surface water or groundwater, including saline waters, within the boundaries of the State" as defined in the California Water Code Sec. 13050(e), including all waters within the boundaries of the State, whether private or public, in natural or artificial channels, and waters in an irrigation system.

72. Wetland. Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (40 CFR 230.3(t)).

73. Wildlife Habitat. Uses of water that support terrestrial or wetland ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats or wetlands, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION

MONITORING AND REPORTING PROGRAM
ORDER NO. R3-2012-0011-01

TIER 1

DISCHARGERS ENROLLED UNDER
THE CONDITIONAL WAIVER OF WASTE DISCHARGE REQUIREMENTS FOR DISCHARGES FROM IRRIGATED LANDS

This Monitoring and Reporting Program Order No. R3-2012-0011-01 (MRP) is issued pursuant to California Water Code (Water Code) section 13267 and 13269, which authorize the California Regional Water Quality Control Board, Central Coast Region (hereafter Central Coast Water Board) to require preparation and submittal of technical and monitoring reports. Water Code section 13269 requires a waiver of waste discharge requirements to include as a condition, the performance of monitoring and the public availability of monitoring results. The Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands Order No. R3-2012-0011 (Order) includes criteria and requirements for three tiers. This MRP sets forth monitoring and reporting requirements for **Tier 1 Dischargers** enrolled under the Order. A summary of the requirements is shown below.

SUMMARY OF MONITORING AND REPORTING REQUIREMENTS FOR TIER 1:

Part 1: Surface Receiving Water Monitoring and Reporting *(cooperative or individual)*;
Part 2: Groundwater Monitoring and Reporting;

Pursuant to Water Code section 13269(a)(2), monitoring requirements must 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 monitoring and reports required by this MRP are to evaluate effects of discharges of waste from irrigated agricultural operations and individual farms/ranches on waters of the state and to determine compliance with the Order.

MONITORING AND REPORTING BASED ON TIERS

The Order and MRP includes criteria and requirements for three tiers, based upon those characteristics of individual farms/ranches at the operation that present the highest level of waste discharge or greatest risk to water quality. Dischargers must meet conditions of the Order and MRP for the appropriate tier that applies to their land and/or the individual farm/ranch. Within a tier, Dischargers comply with requirements based on the specific level of discharge and threat to water quality from individual farms/ranches. The lowest tier, Tier 1, applies to dischargers who discharge the lowest level of waste (amount or concentration) or pose the lowest potential to cause or contribute to an exceedance of water quality standards in waters of the State or of the United States. The highest tier, Tier 3, applies to dischargers who discharge the highest level of waste or pose the greatest potential to cause or contribute to an exceedance of water quality standards in waters of the State or of the United States. Tier 2 applies to dischargers whose discharge has a moderate threat to water quality. Water quality is defined in terms of Regional, State, or Federal numeric or narrative water quality standards. Per the Order, Dischargers may submit a request to the Executive Officer to approve transfer to a lower tier.

PART 1. SURFACE RECEIVING WATER MONITORING AND REPORTING REQUIREMENTS

Monitoring and reporting requirements for surface receiving water identified in Part 1.A. and Part 1.B. apply to Tier 1 Dischargers. Surface receiving water refers to water flowing in creeks and other surface waters of the State. Surface receiving water monitoring may be conducted through a **cooperative monitoring program**, or Dischargers may choose to conduct surface receiving water monitoring and reporting individually. Key monitoring and reporting requirements for surface receiving water are shown in Tables 1 and 2. Time schedules are shown in Table 4.

A. Surface Receiving Water Quality Monitoring

1. Dischargers must elect a surface receiving water monitoring option (cooperative monitoring program or individual receiving water monitoring) to comply with surface receiving water quality monitoring requirements, and identify the option selected on the Notice of Intent (NOI).

2. Dischargers are encouraged to choose participation in a cooperative monitoring program (e.g., the existing Cooperative Monitoring Program or a similar program) to comply with receiving water quality monitoring requirements. Dischargers not participating in a cooperative monitoring program must conduct surface receiving water quality monitoring individually that achieves the same purpose.

3. Dischargers (individually or as part of a cooperative monitoring program) must conduct surface receiving water quality monitoring to a) assess the impacts of waste discharges from irrigated lands to receiving water, b) assess the status of receiving water quality and beneficial use protection in impaired waterbodies dominated by irrigated agricultural activity, c) evaluate status, short term patterns and long term trends (five to ten years or more) in receiving water quality, d) evaluate water quality impacts resulting from agricultural discharges (including but not limited to tile drain

discharges), e) evaluate stormwater quality, f) evaluate condition of existing perennial, intermittent, or ephemeral streams or riparian or wetland area habitat, including degradation resulting from erosion or agricultural discharges of waste, and g) assist in the identification of specific sources of water quality problems.

<u>Surface Receiving Water Quality Sampling and Analysis Plan</u>

4. **Within three months** of adoption of the Order, Dischargers (individually or as part of a cooperative monitoring program) must submit a surface receiving water quality Sampling and Analysis Plan and Quality Assurance Project Plan (QAPP). Dischargers (or a third party cooperative monitoring program) must develop the Sampling and Analysis Plan to describe how the proposed monitoring will achieve the objectives of the MRP and evaluate compliance with the Order. The Sampling and Analysis Plan may propose alternative monitoring site locations, adjusted monitoring parameters, and other changes as necessary to assess the impacts of waste discharges from irrigated lands to receiving water. The Executive Officer must approve the Sampling and Analysis Plan and QAPP.

5. The Sampling and Analysis Plan must include the following minimum required components:
   a. Monitoring strategy to achieve objectives of the Order and MRP;
   b. Map of monitoring sites with GIS coordinates;
   c. Identification of known water quality impairments and impaired waterbodies per the 2010 Clean Water Act 303(d) List of Impaired Waterbodies (List of Impaired Waterbodies);
   d. Identification of beneficial uses and applicable water quality standards;
   e. Identification of applicable Total Maximum Daily Loads;
   f. Monitoring parameters;
   g. Monitoring schedule, including description and frequencies of monitoring events;
   h. Description of data analysis methods;

6. The QAPP must include receiving water and site-specific information, project organization and responsibilities, and quality assurance components of the MRP. The QAPP must also include the laboratory and field requirements to be used for analyses and data evaluation. The QAPP must contain adequate detail for project and Water Board staff to identify and assess the technical and quality objectives, measurement and data acquisition methods, and limitations of the data generated under the surface receiving water quality monitoring. All sampling and laboratory methodologies and QAPP content must be consistent with U.S. EPA

methods, State Water Board's Surface Water Ambient Monitoring Program (SWAMP) protocols and the Central Coast Water Board's Central Coast Ambient Monitoring Program (CCAMP). Following U.S. EPA guidelines[1] and SWAMP templates[2], the receiving water quality monitoring QAPP must include the following minimum required components:

a. Project Management. This component addresses basic project management, including the project history and objectives, roles and responsibilities of the participants, and other aspects.
b. Data Generation and Acquisition. This component addresses all aspects of project design and implementation. Implementation of these elements ensures that appropriate methods for sampling, measurement and analysis, data collection or generation, data handling, and quality control activities are employed and are properly documented. Quality control requirements are applicable to all the constituents sampled as part of the MRP, as described in the appropriate method.
c. Assessment and Oversight. This component addresses the activities for assessing the effectiveness of the implementation of the project and associated QA and QC activities. The purpose of the assessment is to provide project oversight that will ensure that the QA Project Plan is implemented as prescribed.
d. Data Validation and Usability. This component addresses the quality assurance activities that occur after the data collection, laboratory analysis and data generation phase of the project is completed. Implementation of these elements ensures that the data conform to the specified criteria, thus achieving the MRP objectives.

7. The Central Coast Water Board may conduct an audit of contracted laboratories at any time in order to evaluate compliance with the QAPP.

8. The Sampling and Analysis Plan and QAPP, and any proposed revisions are subject to approval by the Executive Officer. The Executive Officer may also revise the Sampling and Analysis Plan, including adding, removing, or changing monitoring site locations, changing monitoring

[1] USEPA. 2001 (2006) USEPA Requirements for Quality Assurance Project Plans (QA/R-5) Office of Environmental Information, Washington, D.C. USEPA QA/R-5
[2] http://waterboards.ca.gov/water_issues/programs/swamp/tools.shtml#qa

parameters, and other changes as necessary to assess the impacts of waste discharges from irrigated lands to receiving water.

Surface Receiving Water Quality Monitoring Sites

9. The Sampling and Analysis Plan must, at a minimum, include monitoring sites to evaluate waterbodies identified in Table 1, unless otherwise approved by the Executive Officer. The Sampling and Analysis Plan must include sites to evaluate receiving water quality impacts most directly resulting from areas of agricultural discharge (including areas receiving tile drain discharges). Site selection must take into consideration the existence of any long term monitoring sites included in related monitoring programs (e.g. CCAMP and the existing CMP). Sites may be added or modified, subject to prior approval by the Executive Officer, to better assess the pollutant loading from individual sources or the impacts to receiving waters caused by individual dischargers. Any modifications must consider sampling consistency for purposes of trend evaluation.

Surface Receiving Water Quality Monitoring Parameters

10. The Sampling and Analysis Plan must, at a minimum, include the following types of monitoring and evaluation parameters listed below and identified in Table 2:

    a. Flow Monitoring;
    b. Water Quality (physical parameters, metals, nutrients, pesticides);
    c. Toxicity (water and sediment);
    d. Assessment of Benthic Invertebrates;

11. All analyses must be conducted at a laboratory certified for such analyses by the State Department of Public Health (CDPH) or at laboratories approved by the Executive Officer. Unless otherwise noted, all sampling, sample preservation, and analyses must be performed in accordance with the latest edition of *Test Methods for Evaluating Solid Waste*, SW-846, U.S. EPA, and analyzed as specified herein by the above analytical methods and reporting limits indicated. Certified laboratories can be found at the web link:http://www.cdph.ca.gov/certlic/labs/Documents/ELAPLablist.xls

12. Water quality and flow monitoring is used to assess the sources, concentrations, and loads of waste discharges from individual farms/ranches and groups of Dischargers to surface waters, to evaluate impacts to water quality and beneficial uses, and to evaluate the short term patterns and long term trends in receiving water quality. Monitoring

data must be compared to existing numeric and narrative water quality objectives.

13. Toxicity testing is to evaluate water quality relative to the narrative toxicity objective. Water column toxicity analyses must be conducted on 100% (undiluted) sample. At sites where persistent unresolved toxicity is found, the Executive Officer may require concurrent toxicity and chemical analyses and a Toxicity Identification Evaluation (TIE) to identify the individual discharges causing of the toxicity.

Surface Receiving Water Quality Monitoring Frequency and Schedule

14. The Sampling and Analysis Plan must include a schedule for sampling. Timing, duration, and frequency of monitoring must be based on the land use, complexity, hydrology, and size of the waterbody. Table 2 includes minimum monitoring frequency and parameter lists. Agricultural parameters that are less common may be monitored less frequently. Modifications to the receiving water quality monitoring parameters, frequency, and schedule may be submitted for Executive Officer consideration and approval. At a minimum, the Sampling and Analysis Plan schedule must consist of monthly monitoring of common agricultural parameters in major agricultural areas, including two major storm events during the wet season (October 1 – April 30).

15. Storm event monitoring must be conducted within 18 hours of storm events, preferably including the first flush run-off event that results in significant increase in stream flow. For purposes of this MRP, a storm event is defined as precipitation producing onsite runoff (surface water flow) capable of creating significant ponding, erosion or other water quality problem. A significant storm event will generally result in greater than 1-inch of rain within a 24-hour period.

16. **Within six months** of adoption of the Order, Dischargers (individually or as part of a cooperative monitoring program) must initiate receiving water quality monitoring per the Sampling and Analysis Plan and QAPP approved by the Executive Officer.

B. Surface Receiving Water Quality Reporting

Surface Receiving Water Quality Data Submittal

1. **Within nine months** of adoption of this Order and quarterly thereafter (by January 1, April 1, July 1, and October 1), Dischargers (individually or as part of a cooperative monitoring program) must submit water quality

monitoring data to the Central Coast Water Board electronically, in a format specified by the Executive Officer and compatible with SWAMP/CCAMP electronic submittal guidelines.

Surface Receiving Water Quality Monitoring Annual Report

2. **Within one year** of adoption of this Order and annually thereafter by January 1, Dischargers (individually or as part of a cooperative monitoring program) must submit an Annual Report electronically, in a format specified by the Executive Officer, including the following minimum elements:
   a. Signed Transmittal Letter;
   b. Title Page;
   c. Table of Contents;
   d. Executive Summary;
   e. Summary of Exceedance Reports submitted during the reporting period;
   f. Monitoring objectives and design;
   g. Monitoring site descriptions and rainfall records for the time period covered;
   h. Location of monitoring sites and map(s);
   i. Tabulated results of all analyses arranged in tabular form so that the required information is readily discernible;
   j. Summary of water quality data for any sites monitored as part of related monitoring programs, and used to evaluate receiving water as described in the Sampling and Analysis Plan.
   k. Discussion of data to clearly illustrate compliance with the Order and water quality standards;
   l. Discussion of short term patterns and long term trends in receiving water quality and beneficial use protection;
   m. Evaluation of pesticide and toxicity analyses results, and recommendation of candidate sites for Toxicity Identification Evaluations (TIEs);
   n. Identification of the location of any agricultural discharges observed discharging directly to surface receiving water;
   o. Electronic data submitted in a SWAMP/CCAMP comparable format;
   p. Sampling and analytical methods used;
   q. Copy of chain-of-custody forms;
   r. Field data sheets, signed laboratory reports, laboratory raw data;
   s. Associated laboratory and field quality control samples results;
   t. Summary of Quality Assurance Evaluation results;
   u. Specify the method used to obtain flow at each monitoring site during each monitoring event;
   v. Electronic or hard copies of photos obtained from all monitoring sites, clearly labeled with site ID and date;
   w. Conclusions;

PART 2. GROUNDWATER MONITORING AND REPORTING REQUIREMENTS

Monitoring and reporting requirements for groundwater identified in Part 2.A. and Part 2.B. apply to Tier 1 Dischargers. Key monitoring and reporting requirements for groundwater are shown in Table 3. Time schedules are shown in Table 4.

A. Individual Groundwater Monitoring

1. **Within one year** of adoption of the Order, Dischargers must initiate sampling of private domestic drinking water and agricultural groundwater wells on their farm/ranch to evaluate groundwater conditions in agricultural areas, identify areas at greatest risk for nitrogen loading and exceedance of drinking water standards, and identify priority areas for follow up actions.

2. Dischargers must sample at least one groundwater well for each farm/ranch on their operation. For farms/ranches with multiple groundwater wells, Dischargers must sample the primary irrigation well and all wells that are used or may be used for drinking water purposes. Groundwater monitoring parameters must include well screen interval depths (if available), general chemical parameters, and general cations and anions listed in Table 3.

3. Dischargers must conduct two rounds of monitoring groundwater wells, one sample collected during fall **(September - December)** and one collected during spring (**March - June)**. The first round of monitoring must be completed by December 2012. These two rounds of monitoring must be repeated every 5 years. As an alternative to groundwater monitoring requirements, where existing groundwater data is available, Dischargers may submit the following for Executive Officer approval:
   a. Existing groundwater quality data for individual farms/ranches that meet the following criteria: 1) at least one groundwater well for an individual farm/ranch, 2) a minimum of two samples collected for each well within the last five years, and 3) samples analyzed for nitrate using U.S. EPA approved analytical methods.
   b. Reference or citation of local groundwater quality monitoring study that includes data collected within the last 5 years and documents that local groundwater quality in the uppermost aquifer does not exceed drinking water standards.

4. Groundwater samples must be collected by a qualified third-party (e.g., consultant, technician, person conducting cooperative monitoring) using proper sampling methods, chain-of-custody, and quality assurance/quality control protocols. Groundwater samples must be collected at or near the well head before the pressure tank and prior to any well head treatment. In cases where this is not possible, the water sample must be collected from a

sampling point as close to the pressure tank as possible, or from a cold-water spigot located before any filters or water treatment systems.

5. Laboratory analyses for groundwater samples must be conducted by a State certified laboratory according to U.S. EPA approved methods; unless otherwise noted, all monitoring, sample preservation, and analyses must be performed in accordance with the latest edition of *Test Methods for Evaluating Solid Waste*, SW-846, United States Environmental Protection Agency, and analyzed as specified herein by the above analytical methods and reporting limits indicated. Certified laboratories can be found at the web link : http://www.cdph.ca.gov/certlic/labs/Documents/ELAPLablist.xls

6. In lieu of conducting individual groundwater monitoring, Dischargers may participate in a cooperative groundwater monitoring effort to help minimize costs and to develop an effective groundwater monitoring program. Qualifying cooperative groundwater monitoring and reporting programs may include, but are not limited to, regional or subregional groundwater programs developed for other purposes as long as the proposed cooperative groundwater monitoring program meets the Central Coast Water Board's general purpose of characterizing groundwater quality and ensuring the protection of drinking water sources. Proposals for cooperative groundwater monitoring efforts, including the use of other regional or subregional groundwater monitoring programs, must be approved by the Executive Officer. At a minimum, the cooperative groundwater monitoring effort must include sufficient monitoring to adequately characterize the groundwater aquifer(s) in the local area of the participating Dischargers, characterize the groundwater quality of the uppermost aquifer, and identify and evaluate groundwater used for domestic drinking water purposes. Cooperative groundwater monitoring efforts must comply with the requirements for sampling protocols and laboratory analytical methods identified in this MRP, including parameters listed in Table 3, or propose a functional equivalent that meets the same objectives and purposes as individual groundwater monitoring. The cooperative groundwater monitoring program must report results consistent with individual groundwater reporting defined in part 2.B, or report results in a manner that is consistent with that approved by the Executive Officer in his or her approval of the cooperative groundwater monitoring proposal. Dischargers electing to participate in a cooperative groundwater monitoring effort must convey this election to the Central Coast Water Board **by August 1, 2012**, and the individual groundwater monitoring requirements shall not apply as long as a cooperative groundwater monitoring proposal for that Discharger's area is submitted within one (1) year of adoption of this Order. If no cooperative groundwater monitoring proposal for that Discharger's area is submitted within one (1) year, then the individual

groundwater monitoring provisions shall apply and the Discharger shall have one (1) year to comply with the provisions identified in Part 2.

B. Individual Groundwater Reporting

1. **By October 1, 2013**, Dischargers must submit groundwater monitoring results and information, electronically, in a format specified by the Executive Officer. Dischargers must include the following information:
   a. Signed transmittal letter;
   b. Number of groundwater wells present at each farm/ranch;
   c. Identification of any groundwater wells abandoned or destroyed (including method destroyed) in compliance with the Order;
   d. Owner-assigned well identification;
   e. State identification number, if available;
   f. Well location (latitude and longitude);
   g. Water-use category (e.g., domestic drinking water, agricultural);
   h. Identification of primary irrigation well;
   i. Well construction information (e.g., total depth, screened intervals, depth to water), as available;
   j. Use for fertigation or chemigation;
   k. Presence and type of back flow prevention devices;
   l. Photo-documentation of well condition and back flow prevention device **(photos must be maintained in the Farm Plan and submitted upon request of the Executive Officer);**
   m. Identification of wells sampled to comply with the Order and MRP;
   n. Laboratory data must be compatible with the Water Board's Groundwater Ambient Monitoring and Assessment (GAMA) Program, and GeoTracker electronic deliverable format (EDF).

Note: The above information (a-n) is reported electronically in the Notice of Intent and groundwater reporting to the GeoTracker data management system. It is not necessary for Dischargers to prepare and submit a separate technical report that includes this information.

PART 3. GENERAL MONITORING AND REPORTING REQUIREMENTS

A. Submittal of Technical Reports

1. Dischargers must submit reports in a format specified by the Executive Officer. A transmittal letter must accompany each report, containing the following penalty of perjury statement signed by the Discharger or the Discharger's authorized agent:

"In compliance with Water Code §13267, I certify under penalty of perjury that this document and all attachments were prepared by me, or under my direction or supervision following a system designed to assure that qualified personnel properly gather and evaluate the information submitted. To the best of my knowledge and belief, this document and all attachments are true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment".

2. If the Discharger asserts that all or a portion of a report submitted pursuant to this Order is subject to an exemption from public disclosure (e.g. trade secrets or secret processes), the Discharger must provide an explanation of how those portions of the reports are exempt from public disclosure. The Discharger must clearly indicate on the cover of the report (typically an electronic submittal) that the Discharger asserts that all or a portion of the report is exempt from public disclosure, submit a complete report with those portions that are asserted to be exempt in redacted form, submit separately (in a separate electronic file) unredacted pages (to be maintained separately by staff). The Central Coast Water Board staff will determine whether any such report or portion of a report qualifies for an exemption from public disclosure. If the Central Coast Water Board staff disagrees with the asserted exemption from public disclosure, the Central Coast Water Board staff will notify the Discharger prior to making such report or portions of such report available for public inspection. In the interest of public health and safety, the Central Coast Water Board will not make available for public inspection, the precise location of any groundwater well monitored in compliance with this Order. Consistent with the reporting of groundwater wells on GeoTracker, groundwater well location and data will only be referenced within a one-half mile radius of the actual well location.

B. Enforcement and Violations

1. Monitoring reports are required pursuant to Section 13267 of the California Water Code. Pursuant to Section 13268 of the Water Code, a violation of a request made pursuant to Section 13267 may subject you to civil liability assessment of up to $1000 per day.

C. Executive Officer Authority

1. The Executive Officer may revise this MRP as necessary, and Dischargers must comply with the MRP as revised by the Executive Officer. Specifically, the Executive Officer may increase monitoring and reporting requirements where monitoring results, pesticide use patterns, or other indicators suggest that the increase is warranted due to an increased threat to water quality. Additionally, the Executive Officer can reduce monitoring and reporting

requirements, including adjusting time schedules, where growers are coordinating efforts at watershed or subwatershed scales or where regional treatment facilities are implemented, or other indicators suggest that the reduction is warranted due to a reduced threat to water quality.

____
for Kenneth Harris, Jr.
Interim Acting Executive Officer

August 10, 2012
____
Date

Table 1. Major Waterbodies in Agricultural Areas[1]

Hydrologic SubArea	Waterbody Name	Hydrologic SubArea	Waterbody Name
30510	Pajaro River	30920	Quail Creek
30510	Salsipuedes Creek	30920	Salinas Reclamation Canal
30510	Watsonville Slough	31022	Chorro Creek
30510	Watsonville Creek[2]	31023	Los Osos Creek
30510	Beach Road Ditch[2]	31023	Warden Creek
30530	Carnadero Creek	31024	San Luis Obispo Creek
30530	Furlong Creek[2]	31024	Prefumo Creek
30530	Llagas Creek	31031	Arroyo Grande Creek
30530	Miller's Canal	31031	Los Berros Creek
30530	San Juan Creek	31210	Bradley Canyon Creek
30530	Tesquisquita Slough	31210	Bradley Channel
30600	Moro Cojo Slough	31210	Green Valley Creek
30910	Alisal Slough	31210	Main Street Canal
30910	Blanco Drain	31210	Orcutt Solomon Creek
30910	Old Salinas River	31210	Oso Flaco Creek
30910	Salinas River (below Gonzales Rd.)	31210	Little Oso Flaco Creek
30920	Salinas River (above Gonzales Rd. and below Nacimiento R.)	31210	Santa Maria River
30910	Santa Rita Creek[2]	31310	San Antonio Creek[2]
30910	Tembladero Slough	31410	Santa Ynez River
30920	Alisal Creek	31531	Bell Creek
30920	Chualar Creek	31531	Glenn Annie Creek
30920	Espinosa Slough	31531	Los Carneros Creek[2]
30920	Gabilan Creek	31534	Arroyo Paredon Creek
30920	Natividad Creek	31534	Franklin Creek

[1] At a minimum, sites must be included for these waterbodies in agricultural areas, unless otherwise approved by the Executive Officer. Sites may be proposed for addition or modification to better assess the impacts of waste discharges from irrigated lands to surface water. Dischargers choosing to comply with surface receiving water quality monitoring, individually (not part of a cooperative monitoring program) must only monitor sites for waterbodies receiving the discharge.

[2] These creeks are included because they are newly listed waterbodies on the 2010 303(d) list of Impaired Waters that are associated with areas of agricultural discharge.

Table 2. Surface Receiving Water Quality Monitoring Parameters

Parameters and Tests	RL[3]	Monitoring Frequency[1]
Photo Monitoring		
Upstream and downstream photographs at monitoring location		With every monitoring event
WATER COLUMN SAMPLING		
Physical Parameters and General Chemistry		
Flow (field measure) (CFS) following SWAMP field SOP[9]	.25	Monthly, including 2 stormwater events
pH (field measure)	0.1	”
Electrical Conductivity (field measure) (uS/cm)	2.5	”
Dissolved Oxygen (field measure) (mg/L)	0.1	”
Temperature (field measure) (^{o}C)	0.1	”
Turbidity (NTU)	0.5	”
Total Dissolved Solids (mg/L)	10	”
Total Suspended Solids (mg/L)	0.5	”
Nutrients		
Total Nitrogen (mg/L)	0.5	Monthly, including 2 stormwater events
Nitrate + Nitrite (as N) (mg/L)	0.1	”
Total Ammonia (mg/L)	0.1	”
Unionized Ammonia (calculated value, mg/L))		”
Total Phosphorus (as P) (mg/L)	-	”
Soluble Orthophosphate (mg/L)	0.01	”
Water column chlorophyll a (mg/L)	0.002	“
Algae cover, Floating Mats, % coverage	-	“
Algae cover, Attached, % coverage	-	“
Water Column Toxicity Test		
Algae -*Selenastrum capricornutum, 4 day*	-	Twice in dry season, twice in wet season
Water Flea – *Ceriodaphnia (7-day chronic)*	-	”
Fathead Minnow - *Pimephales promelas (7-day chronic)*	-	”
Toxicity Identification Evaluation (TIE)	-	As directed by Executive Officer
Pesticides[2] (ug/L)		
Carbamates		
Aldicarb	0.05	4 times, concurrent with water toxicity monitoring, in second year of Order term
Carbaryl	0.05	”

Parameters and Tests	RL[3]	Monitoring Frequency[1]
Carbofuran	0.05	”
Methiocarb	0.05	”
Methomyl	0.05	”
Oxamyl	0.05	”
Organophosphate Pesticides		
Azinphos-methyl	0.02	”
Chlorpyrifos	0.005	”
Diazinon	0.005	”
Dichlorvos	0.01	”
Dimethoate	0.01	”
Dimeton-s	0.005	”
Disulfoton (Disyton)	0.005	”
Malathion	0.005	”
Methamidophos	0.02	”
Methidathion	0.02	“
Parathion-methyl	0.02	“
Phorate	0.01	“
Phosmet	0.02	“
Herbicides		
Atrazine	0.05	“
Cyanazine	0.20	“
Diuron	0.05	“
Glyphosate	2.0	“
Linuron	0.1	“
Paraquat dichloride	4	“
Simazine	0.05	“
Trifluralin	0.05	“
Metals (ug/L)		
Arsenic (total) [5,7]	0.3	4 times, concurrent with water toxicity monitoring, in second year of Order term
Boron (total) [6,7]	10	“
Cadmium (total & dissolved) [4.5,7]	0.01	“
Copper (total and dissolved) [4,7]	0.01	“
Lead (total and dissolved) [4,7]	0.01	“
Nickel (total and dissolved) [4,7]	0.02	“
Molybdenum (total) [7]	1	“
Selenium (total)[7]	0.30	“
Zinc (total and dissolved) [4.5,7]	0.10	“
Other (ug/L)		
Total Phenolic Compounds[8]	10	4 times, concurrent with water toxicity monitoring, in second year of Order term
Hardness (mg/L as CaCO3)	1	“
Total Organic Carbon (ug/L)	0.6	“

Parameters and Tests	RL[3]	Monitoring Frequency[1]
SEDIMENT SAMPLING		
Sediment Toxicity - Hyalella azteca 10-day		Annually
Benthic Invertebrate and associated Physical Habitat Assessment	SWAMP SOP	Once during the second year of Order concurrent with sediment toxicity sampling
Pyrethroid Pesticides in Sediment (ug/kg)		
Gamma-cyhalothrin	2	Once during second year of Order, concurrent with sediment toxicity sampling
Lambda-cyhalothrin	2	
Bifenthrin	2	"
Beta-cyfluthrin	2	"
Cyfluthrin	2	"
Esfenvalerate	2	"
Permethrin	2	"
Cypermethrin	2	"
Danitol	2	"
Fenvalerate	2	"
Fluvalinate	2	"
Organochlorine Pesticides in Sediment		
DCPA	10	"
Dicofol	2	"
Other Monitoring in Sediment		
Chlorpyrifos (ug/kg)	2	"
Total Organic Carbon	0.01%	"
Sulfide		"
Sediment Grain Size Analysis	1%	"

[1]Monitoring is ongoing through all five years of the Order, unless otherwise specified. Monitoring frequency may be used as a guide for developing alternative Sampling and Analysis Plan.
[2]Pesticide list may be modified based on specific pesticide use in Central Coast Region. Analytes on this list must be reported, at a minimum.
[3] Reporting Limit, taken from SWAMP where applicable.
[4] Holmgren, Meyer, Cheney and Daniels. 1993. Cadmium, Lead, Zinc, Copper and Nickel in Agricultural Soils of the United States. J. of Environ. Quality 22:335-348.
[5]Sax and Lewis, ed. 1987. Hawley's Condensed Chemical Dictionary. 11th ed. New York: Van Nostrand Reinhold Co., 1987. Zinc arsenate is an insecticide.
[6]Http://www.coastalagro.com/products/labels/9%25BORON.pdf; Boron is applied directly or as a component of fertilizers as a plant nutrient.
[7]Madramootoo, Johnston, Willardson, eds. 1997. Management of Agricultural Drainage Water Quality. International Commission on Irrigation and Drainage. U.N. FAO. SBN 92-6-104058.3.
[8]http://cat.inist.fr/?aModele=afficheN&cpsidt=14074525; Phenols are breakdown products of herbicides and pesticides. Phenols can be directly toxic and cause endocrine disruption.
[9]See SWAMP field measures SOP, p. 17
mg/L – milligrams per liter; ug/L – micrograms per liter; ug/kg – micrograms per kilogram;
NTU – Nephelometric Turbidity Units; CFS – cubic feet per second;

Table 3. Groundwater Sampling Parameters

Parameter	RL	Analytical Method[3]	Units
pH	0.1	Field or Laboratory Measurement EPA General Methods	pH Units
Specific Conductance	2.5		µS/cm
Total Dissolved Solids	10		mg/L
Total Alkalinity as $CaCO_3$		EPA Method 310.1 or 310.2	
Calcium	0.05	General Cations[1] EPA 200.7, 200.8, 200.9	
Magnesium	0.02		
Sodium	0.1		
Potassium	0.1		
Sulfate (SO4)	1.0	General Anions EPA Method 300 or EPA Method 353.2	
Chloride	0.1		
Nitrate + Nitrite (as N)[2] or Nitrate as NO_3	0.1		

[1]General chemistry parameters (major cations and anions) represent geochemistry of water bearing zone and assist in evaluating quality assurance/quality control of groundwater monitoring and laboratory analysis.
[2]The MRP allows analysis of "nitrate plus nitrite" to represent nitrate concentrations. The "nitrate plus nitrite" analysis allows for extended laboratory holding times and relieves the Discharger of meeting the short holding time required for nitrate. Dischargers may also analyze for Nitrate as NO_3.
[3]Dischargers may use alternative analytical methods approved by EPA.
RL – Reporting Limit; µS/cm – micro siemens per centimeter

Table 4. Tier 1 - Time Schedule for Key Monitoring and Reporting Requirements

REQUIREMENT	TIME SCHEDULE[1]
Submit Quality Assurance Project Plan and Sampling And Analysis Plan for Surface Receiving Water Quality Monitoring *(individually or through cooperative monitoring program)*	Within three months
Initiate surface receiving water quality monitoring *(individually or through cooperative monitoring program)*	Within six months
Submit surface receiving water quality monitoring data *(individually or through cooperative monitoring program)*	Within nine months, quarterly thereafter (January 1, April 1, July 1, and October 1)
Submit surface receiving water quality Annual Monitoring Report *(individually or through cooperative monitoring program)*	Within one year, annually thereafter by January 1
Initiate monitoring of groundwater wells	Within one year
Submit groundwater monitoring results	October 1, 2013

[1] Dates are relative to adoption of this Order, unless otherwise specified.

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION

MONITORING AND REPORTING PROGRAM
ORDER NO. R3-2012-0011-02

TIER 2

DISCHARGERS ENROLLED UNDER
THE CONDITIONAL WAIVER OF WASTE DISCHARGE REQUIREMENTS FOR
DISCHARGES FROM IRRIGATED LANDS

This Monitoring and Reporting Program Order No. R3-2012-0011-02 (MRP) is issued pursuant to California Water Code (Water Code) section 13267 and 13269, which authorize the California Regional Water Quality Control Board, Central Coast Region (hereafter Central Coast Water Board) to require preparation and submittal of technical and monitoring reports. Water Code section 13269 requires a waiver of waste discharge requirements to include as a condition, the performance of monitoring and the public availability of monitoring results. The Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands Order No. R3-2012-0011 (Order) includes criteria and requirements for three tiers. This MRP sets forth monitoring and reporting requirements for **Tier 2 Dischargers** enrolled under the Order. A summary of the requirements is shown below.

SUMMARY OF MONITORING AND REPORTING REQUIREMENTS FOR TIER 2:

Part 1: Surface Receiving Water Monitoring and Reporting *(cooperative or individual)*;
Part 2: Groundwater Monitoring and Reporting;
Nitrate Loading Risk Factor Determination and Total Nitrogen Reporting *(required for subset of Tier 2 Dischargers if farm/ranch has high nitrate loading risk to groundwater);*
Part 3: Annual Compliance Form;
Part 4: Photo Monitoring *(required for subset of Tier 2 Dischargers if farm/ranch contains or is adjacent to a waterbody impaired for temperature, turbidity or sediment);*

Pursuant to Water Code section 13269(a)(2), monitoring requirements must 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 monitoring and reports required by this MRP are to evaluate effects of discharges of waste from irrigated agricultural operations and individual farms/ranches on waters of the state and to determine compliance with the Order.

MONITORING AND REPORTING BASED ON TIERS

The Order and MRP includes criteria and requirements for three tiers, based upon those characteristics of the individual farms/ranches at the operation that present the highest level of waste discharge or greatest risk to water quality. Dischargers must meet conditions of the Order and MRP for the appropriate tier that applies to their land and/or the individual farm/ranch. Within a tier, Dischargers comply with requirements based on the specific level of discharge and threat to water quality from individual farms/ranches. The lowest tier, Tier 1, applies to dischargers who discharge the lowest level of waste (amount or concentration) or pose the lowest potential to cause or contribute to an exceedance of water quality standards in waters of the State or of the United States. The highest tier, Tier 3, applies to dischargers who discharge the highest level of waste or pose the greatest potential to cause or contribute to an exceedance of water quality standards in waters of the State or of the United States. Tier 2 applies to dischargers whose discharge has a moderate threat to water quality. Water quality is defined in terms of Regional, State, or Federal numeric or narrative water quality standards. Per the Order, Dischargers may submit a request to the Executive Officer to approve transfer to a lower tier.

PART 1. SURFACE RECEIVING WATER MONITORING AND REPORTING REQUIREMENTS

Monitoring and reporting requirements for surface receiving water identified in Part 1.A. and Part 1.B. apply to Tier 2 Dischargers. Surface receiving water refers to water flowing in creeks and other surface waters of the State. Surface receiving water monitoring may be conducted through a **cooperative monitoring program**, or Dischargers may choose to conduct surface receiving water monitoring and reporting individually. Key monitoring and reporting requirements for surface receiving water are shown in Tables 1 and 2. Time schedules are shown in Table 5.

A. Surface Receiving Water Quality Monitoring

1. Dischargers must elect a surface receiving water monitoring option (cooperative monitoring program or individual receiving water monitoring) to comply with surface receiving water quality monitoring requirements, and identify the option selected on the Notice of Intent (NOI).

2. Dischargers are encouraged to choose participation in a cooperative monitoring program (e.g. the existing Cooperative Monitoring Program or a similar program) to comply with receiving water quality monitoring requirements. Dischargers not participating in a cooperative monitoring program must conduct surface receiving water quality monitoring individually that achieves the same purpose.

3. Dischargers (individually or as part of a cooperative monitoring program) must conduct surface receiving water quality monitoring to a) assess the impacts of waste discharges from irrigated lands to receiving water, b) assess the status of receiving water quality and beneficial use protection in impaired waterbodies dominated by irrigated agricultural activity, c) evaluate status, short term patterns and long term trends (five to ten years or more) in receiving water quality, d) evaluate water quality impacts resulting from agricultural discharges (including but not limited to tile drain discharges), e) evaluate stormwater quality, f) evaluate condition of existing perennial, intermittent, or ephemeral streams or riparian or wetland area habitat, including degradation resulting from erosion or agricultural discharges of waste, and g) assist in the identification of specific sources of water quality problems.

Surface Receiving Water Quality Sampling and Analysis Plan

4. **Within three months** of adoption of the Order, Dischargers (individually or as part of a cooperative monitoring program) must submit a surface receiving water quality Sampling and Analysis Plan and Quality Assurance Project Plan (QAPP). Dischargers (or a third party cooperative monitoring program) must develop the Sampling and Analysis Plan to describe how the proposed monitoring will achieve the objectives of the MRP and evaluate compliance with the Order. The Sampling and Analysis Plan may propose alternative monitoring site locations, adjusted monitoring parameters, and other changes as necessary to assess the impacts of waste discharges from irrigated lands to receiving water. The Executive Officer must approve the Sampling and Analysis Plan and QAPP.

5. The Sampling and Analysis Plan must include the following minimum required components:
    a. Monitoring strategy to achieve objectives of the Order and MRP;
    b. Map of monitoring sites with GIS coordinates;
    c. Identification of known water quality impairments and impaired waterbodies per the 2010 Clean Water Act 303(d) List of Impaired Waterbodies (List of Impaired Waterbodies);
    d. Identification of beneficial uses and applicable water quality standards;
    e. Identification of applicable Total Maximum Daily Loads;
    f. Monitoring parameters;
    g. Monitoring schedule, including description and frequencies of monitoring events;
    h. Description of data analysis methods;

6. The QAPP must include receiving water and site-specific information, project organization and responsibilities, and quality assurance components of the MRP. The QAPP must also include the laboratory and field requirements to be used for analyses and data evaluation. The QAPP must contain adequate detail for project and Water Board staff to identify and assess the technical and quality objectives, measurement and data acquisition methods, and limitations of the data generated under the surface receiving water quality monitoring. All sampling and laboratory methodologies and QAPP content must be consistent with U.S. EPA methods, State Water Board's Surface Water Ambient Monitoring Program (SWAMP) protocols and the Central Coast Water Board's Central Coast Ambient Monitoring Program (CCAMP). Following U.S. EPA guidelines[1] and SWAMP templates[2], the receiving water quality monitoring QAPP must include the following minimum required components:
    a. Project Management. This component addresses basic project management, including the project history and objectives, roles and responsibilities of the participants, and other aspects.
    b. Data Generation and Acquisition. This component addresses all aspects of project design and implementation. Implementation of these elements ensures that appropriate methods for sampling, measurement and analysis, data collection or generation, data handling, and quality control activities are employed and are properly documented. Quality control requirements are applicable to all the constituents sampled as part of the MRP, as described in the appropriate method.
    c. Assessment and Oversight. This component addresses the activities for assessing the effectiveness of the implementation of the project and associated QA and QC activities. The purpose of the assessment is to provide project oversight that will ensure that the QA Project Plan is implemented as prescribed.
    d. Data Validation and Usability. This component addresses the quality assurance activities that occur after the data collection, laboratory analysis and data generation phase of the project is completed. Implementation of these elements ensures that the data conform to the specified criteria, thus achieving the MRP objectives.

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[1] USEPA. 2001 (2006) USEPA Requirements for Quality Assurance Project Plans (QA/R-5) Office of Environmental Information, Washington, D.C. USEPA QA/R-5

[2] http://waterboards.ca.gov/water_issues/programs/swamp/tools.shtml#qa

7. The Central Coast Water Board may conduct an audit of contracted laboratories at any time in order to evaluate compliance with the QAPP.

8. The Sampling and Analysis Plan and QAPP, and any proposed revisions are subject to approval by the Executive Officer. The Executive Officer may also revise the Sampling and Analysis Plan, including adding, removing, or changing monitoring site locations, changing monitoring parameters, and other changes as necessary to assess the impacts of waste discharges from irrigated lands to receiving water.

Surface Receiving Water Quality Monitoring Sites

9. The Sampling and Analysis Plan must, at a minimum, include monitoring sites to evaluate waterbodies identified in Table 1, unless otherwise approved by the Executive Officer. The Sampling and Analysis Plan must include sites to evaluate receiving water quality impacts most directly resulting from areas of agricultural discharge (including areas receiving tile drain discharges). Site selection must take into consideration the existence of any long term monitoring sites included in related monitoring programs (e.g. CCAMP and the existing CMP). Sites may be added or modified, subject to prior approval by the Executive Officer, to better assess the pollutant loading from individual sources or the impacts to receiving waters caused by individual discharges. Any modifications must consider sampling consistency for purposes of trend evaluation.

Surface Receiving Water Quality Monitoring Parameters

10. The Sampling and Analysis Plan must, at a minimum, include the following types of monitoring and evaluation parameters listed below and identified in Table 2:

    a. Flow Monitoring;
    b. Water Quality (physical parameters, metals, nutrients, pesticides);
    c. Toxicity (water and sediment);
    d. Assessment of Benthic Invertebrates;

11. All analyses must be conducted at a laboratory certified for such analyses by the State Department of Public Health (CDPH) or at laboratories approved by the Executive Officer. Unless otherwise noted, all sampling, sample preservation, and analyses must be performed in accordance with the latest edition of *Test Methods for Evaluating Solid Waste*, SW-846, U.S. EPA, and analyzed as specified herein by the above analytical methods

and reporting limits indicated. Certified laboratories can be found at the web link:http://www.cdph.ca.gov/certlic/labs/Documents/ELAPLablist.xls

12. Water quality and flow monitoring is used to assess the sources, concentrations, and loads of waste discharges from individual farms/ranches and groups of dischargers to surface waters, to evaluate impacts to water quality and beneficial uses, and to evaluate the short term patterns and long term trends in receiving water quality. Monitoring data must be compared to existing numeric and narrative water quality objectives.

13. Toxicity testing is to evaluate water quality relative to the narrative toxicity objective. Water column toxicity analyses must be conducted on 100% (undiluted) sample. At sites where persistent unresolved toxicity is found, the Executive Officer may require concurrent toxicity and chemical analyses and a Toxicity Identification Evaluation (TIE) to identify the individual discharges causing the toxicity.

Surface Receiving Water Quality Monitoring Frequency and Schedule

14. The Sampling and Analysis Plan must include a schedule for sampling. Timing, duration, and frequency of monitoring must be based on the land use, complexity, hydrology, and size of the waterbody. Table 2 includes minimum monitoring frequency and parameter lists. Agricultural parameters that are less common may be monitored less frequently. Modifications to the receiving water quality monitoring parameters, frequency, and schedule may be submitted for Executive Officer consideration and approval. At a minimum, the Sampling and Analysis Plan schedule must consist of monthly monitoring of common agricultural parameters in major agricultural areas, including two major storm events during the wet season (October 1 – April 30).

15. Storm event monitoring must be conducted within 18 hours of storm events, preferably including the first flush run-off event that results in significant increase in stream flow. For purposes of this MRP, a storm event is defined as precipitation producing onsite runoff (surface water flow) capable of creating significant ponding, erosion or other water quality problem. A significant storm event will generally result in greater than 1-inch of rain within a 24-hour period.

16. **Within six months** of adoption of the Order, Dischargers (individually or as part of a cooperative monitoring program) must initiate receiving water quality monitoring per the Sampling and Analysis Plan and QAPP approved by the Executive Officer.

B. Surface Receiving Water Quality Reporting

Surface Receiving Water Quality Data Submittal

1. **Within nine months** of adoption of this Order and quarterly thereafter (by January 1, April 1, July 1, and October 1), Dischargers (individually or as part of a cooperative monitoring program) must submit water quality monitoring data to the Central Coast Water Board electronically, in a format specified by the Executive Officer and compatible with SWAMP/CCAMP electronic submittal guidelines.

Surface Receiving Water Quality Monitoring Annual Report

2. **Within one year** of adoption of this Order and annually thereafter by January 1, Dischargers (individually or as part of a cooperative monitoring program) must submit an Annual Report, electronically, in a format specified by the Executive Officer including the following minimum elements:
    a. Signed Transmittal Letter;
    b. Title Page;
    c. Table of Contents;
    d. Executive Summary;
    e. Summary of Exceedance Reports submitted during the reporting period;
    f. Monitoring objectives and design;
    g. Monitoring site descriptions and rainfall records for the time period covered;
    h. Location of monitoring sites and map(s);
    i. Tabulated results of all analyses arranged in tabular form so that the required information is readily discernible;
    j. Summary of water quality data for any sites monitored as part of related monitoring programs, and used to evaluate receiving water as described in the Sampling and Analysis Plan.
    k. Discussion of data to clearly illustrate compliance with the Order and water quality standards;
    l. Discussion of short term patterns and long term trends in receiving water quality and beneficial use protection;
    m. Evaluation of pesticide and toxicity analyses results, and recommendation of candidate sites for Toxicity Identification Evaluations (TIEs);
    n. Identification of the location of any agricultural discharges observed discharging directly to surface receiving water;
    o. Laboratory data submitted electronically in a SWAMP/CCAMP comparable format;
    p. Sampling and analytical methods used;

q. Copy of chain-of-custody forms;
r. Field data sheets, signed laboratory reports, laboratory raw data;
s. Associated laboratory and field quality control samples results;
t. Summary of Quality Assurance Evaluation results;
u. Specify the method used to obtain flow at each monitoring site during each monitoring event;
v. Electronic or hard copies of photos obtained from all monitoring sites, clearly labeled with site ID and date;
w. Conclusions;

PART 2. GROUNDWATER MONITORING AND REPORTING REQUIREMENTS

Monitoring and reporting requirements for groundwater identified in Part 2.A., Part 2.B., and Part 2.C. apply to Tier 2 Dischargers. Key monitoring and reporting requirements for groundwater are shown in Table 3. Time schedules are shown in Table 5.

A. Individual Groundwater Sampling

1. **Within one year** of adoption of the Order, Dischargers must initiate sampling of private domestic drinking water and agricultural groundwater wells on their farm/ranch to evaluate groundwater conditions in agricultural areas, identify areas at greatest risk for nitrogen loading and exceedance of drinking water standards, and identify priority areas for follow up actions.

2. Dischargers must sample at least one groundwater well for each farm/ranch on their operation. For farms/ranches with multiple groundwater wells, Dischargers must sample the primary irrigation well and all wells that are used or may be used for drinking water purposes. Groundwater monitoring parameters must include well screen interval depths (if available), general chemical parameters, and general cations and anions listed in Table 3.

3. Dischargers must conduct two rounds of monitoring groundwater wells over a period of one year, one sample collected during fall **(September-December)** and one collected during spring **(March - June)**. The first round of monitoring must be completed by December 2012. These two rounds of sampling must be repeated every 5 years. As an alternative to groundwater monitoring requirements, where existing groundwater data is available, Dischargers may submit the following for Executive Officer approval:
   a. Existing groundwater quality data for individual farms/ranches that meet the following criteria: 1) at least one groundwater well for an individual farm/ranch, 2) a minimum of two samples collected for

each well within the last five years, and 3) samples analyzed for nitrate using U.S. EPA approved analytical methods.

b. Reference or citation of local groundwater quality monitoring study that includes data collected within the last 5 years and documents that local groundwater quality in the uppermost aquifer does not exceed drinking water standards.

4. Groundwater samples must be collected by a qualified third-party (e.g., consultant, technician, person conducting cooperative monitoring) using proper sampling methods, chain-of-custody, and quality assurance/quality control protocols. Groundwater samples must be collected at or near the well head before the pressure tank and prior to any well head treatment. In cases where this is not possible, the water sample must be collected from a sampling point as close to the pressure tank as possible, or from a cold-water spigot located before any filters or water treatment systems.

5. Laboratory analyses for groundwater samples must be conducted by a State certified laboratory according to U.S. EPA approved methods; unless otherwise noted, all monitoring, sample preservation, and analyses must be performed in accordance with the latest edition of *Test Methods for Evaluating Solid Waste*, SW-846, United States Environmental Protection Agency, and analyzed as specified herein by the above analytical methods and reporting limits indicated. Certified laboratories can be found at the web link below:
http://www.cdph.ca.gov/certlic/labs/Documents/ELAPLablist.xls

6. In lieu of conducting individual groundwater monitoring, Dischargers may participate in a cooperative groundwater monitoring effort to help minimize costs and to develop an effective groundwater monitoring program. Qualifying cooperative groundwater monitoring and reporting programs may include, but are not limited to, regional or subregional groundwater programs developed for other purposes as long as the proposed cooperative groundwater monitoring program meets the Central Coast Water Board's general purpose of characterizing groundwater quality and ensuring the protection of drinking water sources. Proposals for cooperative groundwater monitoring efforts, including the use of other regional or subregional groundwater monitoring programs must be approved by the Executive Officer. At a minimum, the cooperative groundwater monitoring effort must include sufficient monitoring to adequately characterize the groundwater aquifer(s) in the local area of the participating Dischargers, characterize the groundwater quality of the uppermost aquifer, and identify and evaluate groundwater used for domestic drinking water purposes. Cooperative groundwater monitoring efforts must comply with the requirements for sampling protocols and laboratory analytical methods identified in this MRP, including parameters

listed in Table 3, or propose a functional equivalent that meets the same objectives and purposes as individual groundwater monitoring. The cooperative groundwater monitoring program must report results consistent with individual groundwater reporting defined in part 2.B, or report results in a manner that is consistent with that approved by the Executive Officer in his or her approval of the cooperative groundwater monitoring proposal. Dischargers electing to participate in a cooperative groundwater monitoring effort must convey this election to the Central Coast Water Board **by August 1, 2012**, and the individual groundwater monitoring requirements shall not apply as long as a cooperative groundwater monitoring proposal for that Discharger's area is submitted within one (1) year of adoption of this Order. If no cooperative groundwater monitoring proposal for that Discharger's area is submitted within one (1) year, then the individual groundwater monitoring provisions shall apply and the Discharger shall have one (1) year to comply with the provisions identified in Part 2.

B. Individual Groundwater Reporting

1. **By October 1, 2013**, Dischargers must submit groundwater sampling results and information, electronically, in a format specified by the Executive Officer. Dischargers must include the following information:
    a. Signed transmittal letter;
    b. Number of groundwater wells present at each farm/ranch;
    c. Identification of any groundwater wells abandoned or destroyed (including method destroyed) in compliance with the Order;
    d. Owner-assigned well identification;
    e. State identification number, if available;
    f. Well location (latitude and longitude);
    g. Water-use category (e.g., domestic drinking water, agricultural);
    h. Identification of primary irrigation well;
    i. Well construction information (e.g., total depth, screened intervals, depth to water), as available;
    j. Use for fertigation or chemigation;
    k. Presence and type of back flow prevention devices;
    l. Photo-documentation of well condition and back flow prevention device **(photos must be maintained in the Farm Plan and submitted upon request of the Executive Officer);**
    m. Identification of wells sampled to comply with the Order and MRP;
    n. Laboratory data must be compatible with the Water Board's Groundwater Ambient Monitoring and Assessment (GAMA) Program, and GeoTracker electronic deliverable format (EDF).

Note: The above information (a-n) is reported electronically in the Notice of Intent and groundwater reporting to the GeoTracker data management

system. t is not necessary for Dischargers to prepare and submit a separate technical report that includes this information.

C. Nitrate Loading Risk Factor Determination and Total Nitrogen Reporting

1. Tier 2 Dischargers must calculate the nitrate loading risk factor for each ranch/farm included in their operations. The nitrate loading risk factor is a measure of the relative risk of loading nitrate to groundwater. Tier 2 Dischargers must determine the nitrate loading risk factor for each ranch/farm, based on the highest risk activity existing at each ranch/farm. For example, if a Discharger uses both sprinkler and drip irrigation on the same crop, they must use the irrigation type “sprinkler” in the nitrate loading risk calculation. To calculate nitrate loading risk, Tier 2 Dischargers must use the criteria and methodology described in Table 4 of this MRP, or use the Nitrate Groundwater Pollution Hazard Index developed by University of California Division of Agriculture and Natural Resources (UCANR).

2. Tier 2 Dischargers may choose to subdivide the ranch/farm into "nitrate loading risk units," based on the variability of ranch/farm conditions for the purposes of complying with this Order. A nitrate loading risk unit is a subdivided unit of the ranch/farm with different farming conditions (irrigation system type, crop type, nitrate concentration in the irrigation water, etc.). The nitrate loading risk unit may be the total ranch, a number of blocks, or an individual block. If a Discharger chooses to subdivide the ranch/farm into individual nitrate loading risk units, the Discharger must maintain individual record keeping, and conduct monitoring and reporting for each nitrate loading risk unit.

3. Tier 2 Dischargers who choose to evaluate nitrate loading risk using the Table 4 criteria and methodology must calculate the ranch/farm or nitrate loading risk unit’s nitrate loading risk level (low, moderate, or high), as described in Table 4. Dischargers must report Nitrate Loading Risk factors and level in the electronic Annual Compliance Form.
   a. LOW - Nitrate loading risk is less than 10;
   b. MODERATE – Nitrate loading risk is between 10 and 15;
   c. HIGH – Nitrate loading risk is more than 15;

4. Tier 2 Dischargers who choose to evaluate nitrate loading risk using the Nitrate Groundwater Pollution Hazard Index must characterize the soil type for the individual farm(s), including any variability in soil type, and utilize the index tool at the Internet link below. Soil types may vary across individual fields, and this variability must be accounted for when using the Nitrate Groundwater Pollution Hazard Index. If the soil type is unknown or if the soil type is not included in the UCANR Nitrate Groundwater Pollution Hazard Index tool, Dischargers must use the Table 4 criteria and

methodology described above. Dischargers must provide documentation of input to the index for crop type, soil type, irrigation type, and deep rip. A resulting Nitrate Groundwater Pollution Hazard Index number greater than or equal to 20 indicates a High Nitrate Loading Risk.

http://ucanr.org/sites/wrc/Programs/Water_Quality/Nitrate_Groundwater_Pollution_Hazard_Index/"

5. Tier 2 Dischargers with individual farms/ranches or nitrate loading risk units that have a HIGH nitrate loading risk must report total nitrogen applied per crop, per acre, per year to each farm/ranch or nitrate loading risk unit in the electronic Annual Compliance Form. Total nitrogen must be reported in units of nitrogen, for any product, form or concentration including, but not limited to, organic and inorganic fertilizers, slow release products, compost, compost teas, manure, extracts, nitrogen present in the soil, and nitrate in irrigation water;
    a. As an alternative to reporting total nitrogen, Tier 2 Dischargers with high nitrate loading risk may propose an individual discharge groundwater monitoring and reporting program (GMRP) plan for approval by the Executive Officer. The GMRP plan must evaluate waste discharge to groundwater from each ranch/farm or nitrate loading risk unit and assess if the waste discharge is of sufficient quality that it will not cause or contribute to exceedances of any nitrate water quality standards in groundwater.

PART 3. ANNUAL COMPLIANCE FORM

Tier 2 Dischargers must submit annual compliance information, electronically, in a format specified by the Executive Officer. The purpose of the electronic Annual Compliance Form is to provide information to the Central Coast Water Board to assist in the evaluation of threat to water quality from individual agricultural discharges of waste and measure progress towards water quality improvement and verify compliance with the Order and MRP. Time schedules are shown in Table 5.

A. Annual Compliance Form

1. **By October 1, 2012 and updated annually thereafter by October 1**, Tier 2 Dischargers must submit an Annual Compliance Form electronically, in a format specified by the Executive Officer. The electronic Annual Compliance Form includes, but is not limited to the following minimum requirements[3]:

[3] Items reported in the Annual Compliance Document are due by October 1, 2012 and annually thereafter, unless otherwise specified.

a. Signed transmittal letter;
b. Verification that any change in general operation or farm/ranch information (e.g., crop type, irrigation type, discharge type) is reported on update to Notice of Intent (NOI);
c. Verification of compliance with monitoring requirements, including any cooperative monitoring fees;
d. Verification of completed Farm Plan and date of last update;
e. Information regarding type and characteristics of discharge (e.g., number of discharge points, estimated flow/volume, number of tailwater days);
f. Identification of any direct agricultural discharges to a stream, lake, estuary, bay, or ocean;
g. Identification of specific farm water quality management practices completed, in progress, and planned to address water quality impacts caused by discharges of waste including irrigation management, pesticide management, nutrient management, salinity management, stormwater management, and sediment and erosion control to achieve compliance with this Order;
h. Nitrate concentration of irrigation water;
i. Identification of the application of any fertilizers, pesticides, fumigants or other chemicals through an irrigation system (e.g. fertigation or chemigation) and proof of proper backflow prevention devices;
j. Description of method and location of chemical applications relative to surface water;
k. Nitrate Loading Risk factors in Table 4 or Nitrate Groundwater Pollution Hazard Index input and Nitrate Loading Risk level;
l. Proof of approved California Department of Fish and Game (CDFG) Streambed Alteration Agreement, as required by CDFG for any work proposed within the bed, bank or channel of a lake or stream, including riparian areas, that has the potential to result in erosion and discharges of waste to waters of the State;

Tier 2 Dischargers with farms/ranches that contain or are adjacent to a waterbody impaired for temperature, turbidity or sediment:

m. Photo monitoring to document condition of streams, riparian, and wetland area habitat and the presence of bare soil within the riparian habitat area that is vulnerable to erosion;

Tier 2 Dischargers with farms/ranches that have High Nitrate Loading Risk:

n. Total nitrogen applied per acre to each farm/ranch or nitrate loading risk unit (in units of nitrogen, in any product, form or concentration) including, but not limited to, organic and inorganic fertilizers, slow release products, compost, compost teas, manure, extracts, nitrogen present in the soil, and nitrate in irrigation water[4];

PART 4. PHOTO MONITORING AND REPORTING REQUIREMENTS

Photo monitoring and reporting requirements identified in Part 4.A. apply to Tier 2 Dischargers that have farms/ranches that contain or are adjacent to a waterbody identified on the List of Impaired Waterbodies as impaired for temperature, turbidity or sediment (see Order Table 1). Time schedules are shown in Table 5.

A. Photo Monitoring and Reporting

1. **By October 1, 2012**, Tier 2 Dischargers that have farms/ranches that contain or are adjacent to a waterbody *impaired for temperature, turbidity or sediment* must conduct photo monitoring to do the following:

    a. Document the existing condition of perennial, intermittent or ephemeral streams (wet or dry), riparian or wetland area habitat; Photo monitoring of existing conditions must be repeated every four years.

2. Tier 2 Dischargers must conduct photo monitoring consistent with protocol established by the Executive Officer. Dischargers must include date of photo, photo location and point of reference in the photo. Photos must be accompanied by explanations and descriptions of the management practices demonstrated in the photos to meet the Basin Plan requirements specified below and must include estimated widths of riparian areas from top of bank.

    Basin Plan (Chapter 5, p. V-13, Section V.G.4 – Erosion and Sedimentation, *"A filter strip of appropriate width, and consisting of undisturbed soil and riparian vegetation or its equivalent, must be maintained, wherever possible, between significant land disturbance activities and watercourses, lakes, bays, estuaries, marshes, and other water bodies. For construction activities, minimum width of the filter strip must be thirty feet, wherever possible…."*

3. Tier 2 Dischargers must **maintain photos in the Farm Plan** and submit upon request of the Executive Officer.

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[4] Due by October 1, 2014 and annually thereafter by October 1.

PART 5. GENERAL MONITORING AND REPORTING REQUIREMENTS

A. Submittal of Technical Reports

1. Dischargers must submit reports in a format specified by the Executive Officer. A transmittal letter must accompany each report, containing the following penalty of perjury statement signed by the Discharger or the Discharger's authorized agent:

   "In compliance with Water Code §13267, I certify under penalty of perjury that this document and all attachments were prepared by me, or under my direction or supervision following a system designed to assure that qualified personnel properly gather and evaluate the information submitted. To the best of my knowledge and belief, this document and all attachments are true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment".

2. If the Discharger asserts that all or a portion of a report submitted pursuant to this Order is subject to an exemption from public disclosure (e.g. trade secrets or secret processes), the Discharger must provide an explanation of how those portions of the reports are exempt from public disclosure. The Discharger must clearly indicate on the cover of the report (typically an electronic submittal) that the Discharger asserts that all or a portion of the report is exempt from public disclosure, submit a complete report with those portions that are asserted to be exempt in redacted form, submit separately (in a separate electronic file) unredacted pages (to be maintained separately by staff). The Central Coast Water Board staff will determine whether any such report or portion of a report qualifies for an exemption from public disclosure. If the Central Coast Water Board staff disagrees with the asserted exemption from public disclosure, the Central Coast Water Board staff will notify the Discharger prior to making such report or portions of such report available for public inspection. In the interest of public health and safety, the Central Coast Water Board will not make available for public inspection, the precise location of any groundwater well monitored in compliance with this Order. Consistent with the reporting of groundwater wells on GeoTracker, groundwater well location and data will only be referenced within a one-half mile radius of the actual well location.

B. Enforcement and Violations

1. Monitoring reports are required pursuant to Section 13267 of the California Water Code. Pursuant to Section 13268 of the Water Code, a violation of a request made pursuant to Section 13267 may subject you to civil liability assessment of up to $1000 per day.

C. Executive Officer Authority

1. The Executive Officer may revise this MRP as necessary, and Dischargers must comply with the MRP as revised by the Executive Officer. Specifically, the Executive Officer may increase monitoring and reporting requirements where monitoring results, pesticide use patterns, or other indicators suggest that the increase is warranted due to an increased threat to water quality. Additionally, the Executive Officer can reduce monitoring and reporting requirements, including adjusting time schedules, where growers are coordinating efforts at watershed or subwatershed scales or where regional treatment facilities are implemented, or other indicators suggest that the reduction is warranted due to a reduced threat to water quality.

____
for Kenneth Harris, Jr.
Interim Acting Executive Officer

August 10, 2012
____
Date

Table 1. Major Waterbodies in Agricultural Areas[1]

Hydrologic SubArea	Waterbody Name	Hydrologic SubArea	Waterbody Name
30510	Pajaro River	30920	Quail Creek
30510	Salsipuedes Creek	30920	Salinas Reclamation Canal
30510	Watsonville Slough	31022	Chorro Creek
30510	Watsonville Creek[2]	31023	Los Osos Creek
30510	Beach Road Ditch[2]	31023	Warden Creek
30530	Carnadero Creek	31024	San Luis Obispo Creek
30530	Furlong Creek[2]	31024	Prefumo Creek
30530	Llagas Creek	31031	Arroyo Grande Creek
30530	Miller's Canal	31031	Los Berros Creek
30530	San Juan Creek	31210	Bradley Canyon Creek
30530	Tesquisquita Slough	31210	Bradley Channel
30600	Moro Cojo Slough	31210	Green Valley Creek
30910	Alisal Slough	31210	Main Street Canal
30910	Blanco Drain	31210	Orcutt Solomon Creek
30910	Old Salinas River	31210	Oso Flaco Creek
30910	Salinas River (below Gonzales Rd.)	31210	Little Oso Flaco Creek
30920	Salinas River above Gonzales Rd. and below Nacimiento R.)	31210	Santa Maria River
30910	Santa Rita Creek[2]	31310	San Antonio Creek[2]
30910	Tembladero Slough	31410	Santa Ynez River
30920	Alisal Creek	31531	Bell Creek
30920	Chualar Creek	31531	Glenn Annie Creek
30920	Espinosa Slough	31531	Los Carneros Creek[2]
30920	Gabilan Creek	31534	Arroyo Paredon Creek
30920	Natividad Creek	31534	Franklin Creek

[1] At a minimum, sites must be included for these waterbodies in agricultural areas, unless otherwise approved by the Executive Officer. Sites may be proposed for addition or modification to better assess the impacts of waste discharges from irrigated lands to surface water. Dischargers choosing to comply with surface receiving water quality monitoring, individually (not part of a cooperative monitoring program) must only monitor sites for waterbodies receiving the discharge.

[2] These creeks are included because they are newly listed waterbodies on the 2010 303(d) list of Impaired Waters that are associated with areas of agricultural discharge.

Table 2. Surface Receiving Water Quality Monitoring Parameters

Parameters and Tests	RL[3]	Monitoring Frequency[1]
Photo Monitoring		
Upstream and downstream photographs at monitoring location		With every monitoring event
WATER COLUMN SAMPLING		
Physical Parameters and General Chemistry		
Flow (field measure) (CFS) following SWAMP field SOP[9]	.25	Monthly, including 2 stormwater events
pH (field measure)	0.1	”
Electrical Conductivity (field measure) (uS/cm)	2.5	”
Dissolved Oxygen (field measure) (mg/L)	0.1	”
Temperature (field measure) (^{o}C)	0.1	”
Turbidity (NTU)	0.5	”
Total Dissolved Solids (mg/L)	10	”
Total Suspended Solids (mg/L)	0.5	”
Nutrients		
Total Nitrogen (mg/L)	0.5	Monthly, including 2 stormwater events
Nitrate + Nitrite (as N) (mg/L)	0.1	”
Total Ammonia (mg/L)	0.1	”
Unionized Ammonia (calculated value, mg/L))		”
Total Phosphorus (as P) (mg/L)	-	”
Soluble Orthophosphate (mg/L)	0.01	”
Water column chlorophyll a (mg/L)	0.002	“
Algae cover, Floating Mats, % coverage	-	“
Algae cover, Attached, % coverage	-	“
Water Column Toxicity Test		
Algae -*Selenastrum capricornutum, 4 day*	-	Twice in dry season, twice in wet season
Water Flea – *Ceriodaphnia (7-day chronic)*	-	”
Fathead Minnow - *Pimephales promelas (7-day chronic)*	-	”
Toxicity Identification Evaluation (TIE)	-	As directed by Executive Officer
Pesticides[2] (ug/L)		
Carbamates		
Aldicarb	0.05	4 times, concurrent with water toxicity monitoring, in second year of Order term

Parameters and Tests	RL[3]	Monitoring Frequency[1]
Carbaryl	0.05	”
Carbofuran	0.05	”
Methiocarb	0.05	”
Methomyl	0.05	”
Oxamyl	0.05	”
Organophosphate Pesticides		
Azinphos-methyl	0.02	”
Chlorpyrifos	0.005	”
Diazinon	0.005	”
Dichlorvos	0.01	”
Dimethoate	0.01	”
Dimeton-s	0.005	”
Disulfoton (Disyton)	0.005	”
Malathion	0.005	”
Methamidophos	0.02	”
Methidathion	0.02	“
Parathion-methyl	0.02	“
Phorate	0.01	“
Phosmet	0.02	“
Herbicides		
Atrazine	0.05	“
Cyanazine	0.20	“
Diuron	0.05	“
Glyphosate	2.0	“
Linuron	0.1	“
Paraquat dichloride	4	“
Simazine	0.05	“
Trifluralin	0.05	“
Metals (ug/L)		
Arsenic (total) [5,7]	0.3	4 times, concurrent with water toxicity monitoring, in second year of Order term
Boron (total) [6,7]	10	“
Cadmium (total & dissolved) [4.5,7]	0.01	“
Copper (total and dissolved) [4,7]	0.01	“
Lead (total and dissolved) [4,7]	0.01	“
Nickel (total and dissolved) [4,7]	0.02	“
Molybdenum (total) [7]	1	“
Selenium (total)[7]	0.30	“
Zinc (total and dissolved) [4.5,7]	0.10	“
Other (ug/L)		
Total Phenolic Compounds[8]	10	4 times, concurrent with water toxicity monitoring, in second year of Order term
Hardness (mg/L as CaCO3)	1	“
Total Organic Carbon (ug/L)	0.6	“

Parameters and Tests	RL[3]	Monitoring Frequency[1]
SEDIMENT SAMPLING		
Sediment Toxicity - Hyalella azteca 10-day		Annually
Benthic Invertebrate and associated Physical Habitat Assessment	SWAMP SOP	Once during the second year of Order concurrent with sediment toxicity sampling
Pyrethroid Pesticides in Sediment (ug/kg)		
Gamma-cyhalothrin	2	Once during second year of Order, concurrent with sediment toxicity sampling
Lambda-cyhalothrin	2	
Bifenthrin	2	"
Beta-cyfluthrin	2	"
Cyfluthrin	2	"
Esfenvalerate	2	"
Permethrin	2	"
Cypermethrin	2	"
Danitol	2	"
Fenvalerate	2	"
Fluvalinate	2	"
Organochlorine Pesticides in Sediment		
DCPA	10	"
Dicofol	2	"
Other Monitoring in Sediment		
Chlorpyrifos (ug/kg)	2	"
Total Organic Carbon	0.01%	"
Sulfide		"
Sediment Grain Size Analysis	1%	"

[1]Monitoring is ongoing through all five years of the Order, unless otherwise specified. Monitoring frequency may be used as a guide for developing alternative Sampling and Analysis Plan.
[2]Pesticide list may be modified based on specific pesticide use in Central Coast Region. Analytes on this list must be reported, at a minimum.
[3] Reporting Limit, taken from SWAMP where applicable.
[4] Holmgren, Meyer, Cheney and Daniels. 1993. Cadmium, Lead, Zinc, Copper and Nickel in Agricultural Soils of the United States. J. of Environ. Quality 22:335-348.
[5]Sax and Lewis, ed. 1987. Hawley's Condensed Chemical Dictionary. 11th ed. New York: Van Nostrand Reinhold Co., 1987. Zinc arsenate is an insecticide.
[6]Http://www.coastalagro.com/products/labels/9%25BORON.pdf; Boron is applied directly or as a component of fertilizers as a plant nutrient.
[7]Madramootoo, Johnston, Willardson, eds. 1997. Management of Agricultural Drainage Water Quality. International Commission on Irrigation and Drainage. U.N. FAO. SBN 92-6-104058.3.
[8]http://cat.inist.fr/?aModele=afficheN&cpsidt=14074525; Phenols are breakdown products of herbicides and pesticides. Phenols can be directly toxic and cause endocrine disruption.
[9]See SWAMP field measures SOP, p. 17
mg/L – milligrams per liter; ug/L – micrograms per liter; ug/kg – micrograms per kilogram;
NTU – Nephelometric Turbidity Units; CFS – cubic feet per second;

Table 3. Groundwater Monitoring Parameters

Parameter	RL	Analytical Method[3]	Units
pH	0.1	Field or Laboratory Measurement EPA General Methods	pH Units
Specific Conductance	2.5		μS/cm
Total Dissolved Solids	10		mg/L
Total Alkalinity as $CaCO_3$	1	EPA Method 310.1 or 310.2	
Calcium	0.05	General Cations[1] EPA 200.7, 200.8, 200.9	
Magnesium	0.02		
Sodium	0.1		
Potassium	0.1		
Sulfate (SO_4)	1.0	General Anions EPA Method 300 or EPA Method 353.2	
Chloride	0.1		
Nitrate + Nitrite (as N)[2] or Nitrate as NO_3	0.1		

[1]General chemistry parameters (major cations and anions) represent geochemistry of water bearing zone and assist in evaluating quality assurance/quality control of groundwater sampling and laboratory analysis.
[2]The MRP allows analysis of “nitrate plus nitrite” to represent nitrate concentrations. The “nitrate plus nitrite” analysis allows for extended laboratory holding times and relieves the Discharger of meeting the short holding time required for nitrate. Dischargers may also analyze for Nitrate as NO_3.
[3]Dischargers may use alternative analytical methods approved by EPA.
RL – Reporting Limit; μS/cm – micro siemens per centimeter

Table 4. Nitrate Loading Risk Factor Criteria and Risk Level Calculation

A. Crop Type Nitrate Hazard Index Rating

1 - Bean, Grapes, Olive.

2 - Apple, Avocado, Barley, Blackberry, Blueberry, Carrot, Chicory, Citrus, Lemon Oat, Orange, Peach, Pear, Pistachio, Raspberry, Walnut, Wheat.

3 - Artichoke, Bean, Brussel Sprout, Corn, Cucumber, Daikon, Peas, Radish, Squash, Summer, Tomato, Turnip, Squash, Rutabaga, Pumpkin, Potato.

4 – Beet, Broccoli, Cabbage, Cauliflower, Celery, Chinese Cabbage (Napa),Collard, Endive, Kale, Leek, Lettuce, Mustard, Onion, Parsley, Pepper, Spinach, Strawberry.

(Based on UC Riverside Nitrate Hazard Index)

B. Irrigation System Type Rating

1 - Micro-irrigation year round (drip and micro-sprinklers) and no pre-irrigation;

2 - Sprinklers used for pre-irrigation only and then micro-irrigation;

3 - Sprinklers used for germination or at any time during growing season;

4 - Surface irrigation systems (furrow or flood) at any, and/or in combination with any other irrigation system type;

(Based on UC Riverside Nitrate Hazard Index, Adapted for the Central Coast Region)

C. Irrigation Water Nitrate Concentration Rating
1 – Nitrate concentration 0 to 45 mg/liter Nitrate NO3 2 - Nitrate concentration 46 to 60 mg/liter Nitrate NO3 3 - Nitrate concentration 61to 100 mg/liter Nitrate NO3 4 - Nitrate concentration > 100 mg/l Nitrate NO3
D. Nitrate Loading Risk Level Calculation = A x B x C
LOW - Nitrate loading risk is less than 10; MODERATE – Nitrate loading risk is between 10 and 15; HIGH – Nitrate loading risk is more than 15; *Note: Dischargers must determine the nitrate loading risk factor for each ranch/farm, based on the criteria associated with the highest risk activity existing at each ranch/farm. For example, the ranch/farm is assigned the highest risk factor, based on the single highest risk crop in the rotation, on one block under furrow irrigation, or on one well with high nitrate concentration. As an alternative to the nitrate loading risk level calculation described in Table 4, Dischargers may use the Groundwater Pollution Nitrate Hazard Index developed by UCANR, where a resulting Nitrate Hazard Index score equal or greater or equal to 20 indicates a HIGH nitrate loading risk to groundwater.*

Table 5. Tier 2 - Time Schedule for Key Monitoring and Reporting Requirements

REQUIREMENT	TIME SCHEDULE[1]
Submit Quality Assurance Project Plan and Sampling And Analysis Plan for Surface Receiving Water Quality Monitoring (individually or through cooperative monitoring program)	Within three months
Initiate surface receiving water quality monitoring (individually or through cooperative monitoring program)	Within six months
Submit surface receiving water quality monitoring data (individually or through cooperative monitoring program)	Within nine months, quarterly thereafter (January 1, April 1, July 1, and October 1)
Submit surface receiving water quality Annual Monitoring Report (individually or through cooperative monitoring program)	Within one year, annually thereafter by January 1
Initiate monitoring of groundwater wells	Within one year
Tier 2 Dischargers with farms/ranches that contain or are adjacent to a waterbody impaired for temperature, turbidity or sediment: Conduct photo monitoring of riparian or wetland area habitat	October 1, 2012, and every four years thereafter by October 1
Submit electronic Annual Compliance Form	October 1, 2012, and updated annually thereafter by October 1
Submit groundwater monitoring results	October 1, 2013
Tier 2 Dischargers with farms/ranches that have High Nitrate Loading Risk: Report total nitrogen applied per acre to each farm/ranch or nitrate loading risk unit, in electronic Annual Compliance Form	October 1, 2014, and annually thereafter by October 1.

[1] Dates are relative to adoption of this Order or enrollment date for Dischargers enrolled after the adoption of this Order, unless otherwise specified.

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION

MONITORING AND REPORTING PROGRAM ORDER NO. R3-2012-0011-03

TIER 3

DISCHARGERS ENROLLED UNDER THE CONDITIONAL WAIVER OF WASTE DISCHARGE REQUIREMENTS FOR DISCHARGES FROM IRRIGATED LANDS

This Monitoring and Reporting Program Order No. R3-2012-0011-03 (MRP) is issued pursuant to California Water Code (Water Code) section 13267 and 13269, which authorize the California Regional Water Quality Control Board, Central Coast Region (hereafter Central Coast Water Board) to require preparation and submittal of technical and monitoring reports. Water Code section 13269 requires a waiver of waste discharge requirements to include as a condition, the performance of monitoring and the public availability of monitoring results. The Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands Order No. R3-2012-0011 (Order) includes criteria and requirements for three tiers. This MRP sets forth monitoring and reporting requirements for **Tier 3 Dischargers** enrolled under the Order. A summary of the requirements is shown below.

SUMMARY OF MONITORING AND REPORTING REQUIREMENTS FOR TIER 3:

Part 1: Surface Receiving Water Monitoring and Reporting *(cooperative or individual)*;
Part 2: Groundwater Monitoring and Reporting;
Nitrate Loading Risk Factor Determination and Total Nitrogen Reporting *(required for subset of Tier 3 Dischargers if farm/ranch has high nitrate loading risk to groundwater);*
Part 3: Annual Compliance Form;
Part 4: Photo Monitoring *(required for subset of Tier 3 Dischargers if farm/ranch contains or is adjacent to a waterbody impaired for temperature, turbidity or sediment);*
Part 5: Individual Surface Water Discharge Monitoring and Reporting;
Part 6: Irrigation and Nutrient Management Plan *(required for subset of Tier 3 Dischargers if farm/ranch has High Nitrate Loading Risk);*
Part 7: Water Quality Buffer Plan *(required for subset of Tier 3 Dischargers if farm/ranch contains or is adjacent to a waterbody impaired for temperature, turbidity or sediment);*

Pursuant to Water Code section 13269(a)(2), monitoring requirements must 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 monitoring and reports required by this MRP are to evaluate effects of discharges of waste from irrigated agricultural operations and individual farms/ranches on waters of the state and to determine compliance with the Order.

MONITORING AND REPORTING BASED ON TIERS

The Order and MRP includes criteria and requirements for three tiers, based upon those characteristics of the individual farms/ranches at the operation that present the highest level of waste discharge or greatest risk to water quality. Dischargers must meet conditions of the Order and MRP for the appropriate tier that applies to their land and/or the individual farm/ranch. Within a tier, Dischargers comply with requirements based on the specific level of discharge and threat to water quality from individual farms/ranches. The lowest tier, Tier 1, applies to dischargers who discharge the lowest level of waste (amount or concentration) or pose the lowest potential to cause or contribute to an exceedance of water quality standards in waters of the State or of the United States. The highest tier, Tier 3, applies to dischargers who discharge the highest level of waste or pose the greatest potential to cause or contribute to an exceedance of water quality standards in waters of the State or of the United States. Tier 2 applies to dischargers whose discharge has a moderate threat to water quality. Water quality is defined in terms of Regional, State, or Federal numeric or narrative water quality standards. Per the Order, Dischargers may submit a request to the Executive Officer to approve transfer to a lower tier.

PART 1. SURFACE RECEIVING WATER MONITORING AND REPORTING REQUIREMENTS

Monitoring and reporting requirements for surface receiving water identified in Part 1.A. and Part 1.B. apply to Tier 3 Dischargers. Surface receiving water refers to water flowing in creeks and other surface waters of the State. Surface receiving water monitoring may be conducted through a **cooperative monitoring program**, or Dischargers may choose to conduct surface receiving water monitoring and reporting individually. Key monitoring and reporting requirements for surface receiving water are shown in Tables 1 and 2. Time schedules are shown in Table 6.

A. Surface Receiving Water Quality Monitoring

1. Dischargers must elect a surface receiving water monitoring option (cooperative monitoring program or individual receiving water monitoring) to comply with surface receiving water quality monitoring requirements, and identify the option selected on the Notice of Intent (NOI).

2. Dischargers are encouraged to choose participation in a cooperative monitoring program (e.g., the existing Cooperative Monitoring Program or a similar program) to comply with receiving water quality monitoring

requirements. Dischargers not participating in a cooperative monitoring program must conduct surface receiving water quality monitoring individually that achieves the same purpose.

3. Dischargers (individually or as part of a cooperative monitoring program) must conduct surface receiving water quality monitoring to a) assess the impacts of their waste discharges from irrigated lands to receiving water, b) assess the status of receiving water quality and beneficial use protection in impaired waterbodies dominated by irrigated agricultural activity, c) evaluate status, short term patterns and long term trends (five to ten years or more) in receiving water quality, d) evaluate water quality impacts resulting from agricultural discharges (including but not limited to tile drain discharges), e) evaluate stormwater quality, f) evaluate condition of existing perennial, intermittent, or ephemeral streams or riparian or wetland area habitat, including degradation resulting from erosion or agricultural discharges of waste, and g) assist in the identification of specific sources of water quality problems.

Surface Receiving Water Quality Sampling and Analysis Plan

4. **Within three months** of adoption of the Order, Dischargers (individually or as part of a cooperative monitoring program) must submit a surface receiving water quality Sampling and Analysis Plan and Quality Assurance Project Plan (QAPP). Dischargers (or a third party cooperative monitoring program) must develop the Sampling and Analysis Plan to describe how the proposed monitoring will achieve the objectives of the MRP and evaluate compliance with the Order. The Sampling and Analysis Plan may propose alternative monitoring site locations, adjusted monitoring parameters, and other changes as necessary to assess the impacts of waste discharges from irrigated lands to receiving water. The Executive Officer must approve the Sampling and Analysis Plan and QAPP.

5. The Sampling and Analysis Plan must include the following minimum required components:
    a. Monitoring strategy to achieve objectives of the Order and MRP;
    b. Map of monitoring sites with GIS coordinates;
    c. Identification of known water quality impairments and impaired waterbodies per the 2010 Clean Water Act 303(d) List of Impaired Waterbodies (List of Impaired Waterbodies);
    d. Identification of beneficial uses and applicable water quality standards;
    e. Identification of applicable Total Maximum Daily Loads;
    f. Monitoring parameters;

g. Monitoring schedule, including description and frequencies of monitoring events;
h. Description of data analysis methods;

6. The QAPP must include receiving water and site-specific information, project organization and responsibilities, and quality assurance components of the MRP. The QAPP must also include the laboratory and field requirements to be used for analyses and data evaluation. The QAPP must contain adequate detail for project and Water Board staff to identify and assess the technical and quality objectives, measurement and data acquisition methods, and limitations of the data generated under the surface receiving water quality monitoring. All sampling and laboratory methodologies and QAPP content must be consistent with U.S. EPA methods, State Water Board's Surface Water Ambient Monitoring Program (SWAMP) protocols and the Central Coast Water Board's Central Coast Ambient Monitoring Program (CCAMP). Following U.S. EPA guidelines[1] and SWAMP templates[2], the receiving water quality monitoring QAPP must include the following minimum required components:
   a. Project Management. This component addresses basic project management, including the project history and objectives, roles and responsibilities of the participants, and other aspects.
   b. Data Generation and Acquisition. This component addresses all aspects of project design and implementation. Implementation of these elements ensures that appropriate methods for sampling, measurement and analysis, data collection or generation, data handling, and quality control activities are employed and are properly documented. Quality control requirements are applicable to all the constituents sampled as part of the MRP, as described in the appropriate method.
   c. Assessment and Oversight. This component addresses the activities for assessing the effectiveness of the implementation of the project and associated QA and QC activities. The purpose of the assessment is to provide project oversight that will ensure that the QA Project Plan is implemented as prescribed.
   d. Data Validation and Usability. This component addresses the quality assurance activities that occur after the data collection,

[1] USEPA. 2001 (2006) USEPA Requirements for Quality Assurance Project Plans (QA/R-5) Office of Environmental Information, Washington, D.C. USEPA QA/R-5
[2] http://waterboards.ca.gov/water_issues/programs/swamp/tools.shtml#qa

laboratory analysis and data generation phase of the project is completed. Implementation of these elements ensures that the data conform to the specified criteria, thus achieving the MRP objectives.

7. The Central Coast Water Board may conduct an audit of contracted laboratories at any time in order to evaluate compliance with the QAPP.

8. The Sampling and Analysis Plan and QAPP, and any proposed revisions are subject to approval by the Executive Officer. The Executive Officer may also revise the Sampling and Analysis Plan, including adding, removing, or changing monitoring site locations, changing monitoring parameters, and other changes as necessary to assess the impacts of waste discharges from irrigated lands to receiving water.

Surface Receiving Water Quality Monitoring Sites

9. The Sampling and Analysis Plan must, at a minimum, include monitoring sites to evaluate waterbodies identified in Table 1, unless otherwise approved by the Executive Officer. The Sampling and Analysis Plan must include sites to evaluate receiving water quality impacts most directly resulting from areas of agricultural discharge (including areas receiving tile drain discharges). Site selection must take into consideration the existence of any long term monitoring sites included in related monitoring programs (e.g. CCAMP and the existing CMP). Sites may be added or modified, subject to prior approval by the Executive Officer, to better assess the pollutant loading from individual sources or the impacts to receiving waters caused by individual discharges. Any modifications must consider sampling consistency for purposes of trend evaluation.

Surface Receiving Water Quality Monitoring Parameters

10. The Sampling and Analysis Plan must, at a minimum, include the following types of monitoring and evaluation parameters listed below and identified in Table 2:

    a. Flow Monitoring;
    b. Water Quality (physical parameters, metals, nutrients, pesticides);
    c. Toxicity (water and sediment);
    d. Assessment of Benthic Invertebrates;

11. All analyses must be conducted at a laboratory certified for such analyses by the State Department of Public Health (CDPH) or at laboratories approved by the Executive Officer. Unless otherwise noted, all sampling,

sample preservation, and analyses must be performed in accordance with the latest edition of *Test Methods for Evaluating Solid Waste*, SW-846, U.S. EPA, and analyzed as specified herein by the above analytical methods and reporting limits indicated. Certified laboratories can be found at the web link: http://www.cdph.ca.gov/certlic/labs/Documents/ELAPLablist.xls

12. Water quality and flow monitoring is used to assess the sources, concentrations, and loads of waste discharges from individual farms/ranches and groups of Dischargers to surface waters, to evaluate impacts to water quality and beneficial uses, and to evaluate the short term patterns and long term trends in receiving water quality. Monitoring data must be compared to existing numeric and narrative water quality objectives.

13. Toxicity testing is to evaluate water quality relative to the narrative toxicity objective. Water column toxicity analyses must be conducted on 100% (undiluted) sample. At sites where persistent unresolved toxicity is found, the Executive Officer may require concurrent toxicity and chemical analyses and a Toxicity Identification Evaluation (TIE) to identify the individual discharges causing the toxicity.

Surface Receiving Water Quality Monitoring Frequency and Schedule

14. The Sampling and Analysis Plan must include a schedule for sampling. Timing, duration, and frequency of monitoring must be based on the land use, complexity, hydrology, and size of the waterbody. Table 2 includes minimum monitoring frequency and parameter lists. Agricultural parameters that are less common may be monitored less frequently. Modifications to the receiving water quality monitoring parameters, frequency, and schedule may be submitted for Executive Officer consideration and approval. At a minimum, the Sampling and Analysis Plan schedule must consist of monthly monitoring of common agricultural parameters in major agricultural areas, including two major storm events during the wet season (October 1 – April 30).

15. Storm event monitoring must be conducted within 18 hours of storm events, preferably including the first flush run-off event that results in significant increase in stream flow. For purposes of this MRP, a storm event is defined as precipitation producing onsite runoff (surface water flow) capable of creating significant ponding, erosion or other water quality problem. A significant storm event will generally result in greater than 1-inch of rain within a 24-hour period.

16. **Within six months** of adoption of the Order, Dischargers (individually or as part of a cooperative monitoring program) must initiate receiving water

quality monitoring per the Sampling and Analysis Plan and QAPP approved by the Executive Officer.

B. Surface Receiving Water Quality Reporting

Surface Receiving Water Quality Data Submittal

1. **Within nine months** of adoption of this Order and quarterly thereafter (by January 1, April 1, July 1, and October 1), Dischargers (individually or as part of a cooperative monitoring program) must submit water quality monitoring data to the Central Coast Water Board electronically, in a format specified by the Executive Officer and compatible with SWAMP/CCAMP electronic submittal guidelines.

Surface Receiving Water Quality Monitoring Annual Report

2. **Within one year** of adoption of this Order and annually thereafter by January 1, Dischargers (individually or as part of a cooperative monitoring program) must submit an Annual Report, electronically, in a format specified by the Executive Officer including the following minimum elements:
   a. Signed Transmittal Letter;
   b. Title Page;
   c. Table of Contents;
   d. Executive Summary;
   e. Summary of Exceedance Reports submitted during the reporting period;
   f. Monitoring objectives and design;
   g. Monitoring site descriptions and rainfall records for the time period covered;
   h. Location of monitoring sites and map(s);
   i. Tabulated results of all analyses arranged in tabular form so that the required information is readily discernible;
   j. Summary of water quality data for any sites monitored as part of related monitoring programs, and used to evaluate receiving water as described in the Sampling and Analysis Plan.
   k. Discussion of data to clearly illustrate compliance with the Order and water quality standards;
   l. Discussion of short term patterns and long term trends in receiving water quality and beneficial use protection;
   m. Evaluation of pesticide and toxicity analyses results, and recommendation of candidate sites for Toxicity Identification Evaluations (TIEs);
   n. Identification of the location of any agricultural discharges observed discharging directly to surface receiving water;

o. Laboratory data submitted electronically in a SWAMP/CCAMP comparable format;
p. Sampling and analytical methods used;
q. Copy of chain-of-custody forms;
r. Field data sheets, signed laboratory reports, laboratory raw data;
s. Associated laboratory and field quality control samples results;
t. Summary of Quality Assurance Evaluation results;
u. Specify the method used to obtain flow at each monitoring site during each monitoring event;
v. Electronic or hard copies of photos obtained from all monitoring sites, clearly labeled with site ID and date;
w. Conclusions;

PART 2. GROUNDWATER MONITORING AND REPORTING REQUIREMENTS

Monitoring and reporting requirements for groundwater identified in Part 2.A., Part 2.B., and Part 2.C. apply to Tier 3 Dischargers. Key monitoring and reporting requirements for groundwater are shown in Table 3. Time schedules are shown in Table 6.

A. Individual Groundwater Monitoring

1. **Within one year** of adoption of the Order, Dischargers must initiate sampling of private domestic drinking water and agricultural groundwater wells on their farm/ranch to evaluate groundwater conditions in agricultural areas, identify areas at greatest risk for nitrogen loading and exceedance of drinking water standards, and identify priority areas for follow up actions.

2. Dischargers must sample at least one groundwater well for each farm/ranch on their operation. For farms/ranches with multiple groundwater wells, Dischargers must sample the primary irrigation well and all wells that are used or may be used for drinking water purposes. Groundwater monitoring parameters must include well screen interval depths (if available), general chemical parameters, and general cations and anions listed in Table 3.

3. Tier 3 Dischargers must initially conduct two rounds of monitoring of groundwater wells during the first year, one sample collected during fall **(September - December)** and one collected during spring **(March - June),** and once annually thereafter. The first round of monitoring must be completed by December 2012. The annual monitoring must be conducted during the quarter when nitrate concentration was at its maximum, based on initial groundwater monitoring.

4. Groundwater samples must be collected by a qualified third-party (e.g., consultant, technician, person conducting cooperative monitoring) using proper sampling methods, chain-of-custody, and quality assurance/quality control protocols. Groundwater samples must be collected at or near the well head before the pressure tank and prior to any well head treatment. In cases where this is not possible, the water sample must be collected from a sampling point as close to the pressure tank as possible, or from a cold-water spigot located before any filters or water treatment systems.

5. Laboratory analyses for groundwater samples must be conducted by a State certified laboratory according to U.S. EPA approved methods; unless otherwise noted, all monitoring, sample preservation, and analyses must be performed in accordance with the latest edition of *Test Methods for Evaluating Solid Waste*, SW-846, United States Environmental Protection Agency, and analyzed as specified herein by the above analytical methods and reporting limits indicated. Certified laboratories can be found at the web link below:
http://www.cdph.ca.gov/certlic/labs/Documents/ELAPLablist.xls

6. In lieu of conducting individual groundwater monitoring, Dischargers may participate in a cooperative groundwater monitoring effort to help minimize costs and to develop an effective groundwater monitoring program. Qualifying cooperative groundwater monitoring and reporting programs may include, but are not limited to, regional or subregional groundwater programs developed for other purposes as long as the proposed cooperative groundwater monitoring program meets the Central Coast Water Board's general purpose of characterizing groundwater quality and ensuring the protection of drinking water sources. Proposals for cooperative groundwater monitoring efforts, including the use of other regional or subregional groundwater monitoring programs, must be approved by the Executive Officer. At a minimum, the cooperative groundwater monitoring effort must include sufficient monitoring to adequately characterize the groundwater aquifer(s) in the local area of the participating Dischargers, characterize the groundwater quality of the uppermost aquifer, and identify and evaluate groundwater used for domestic drinking water purposes. Cooperative groundwater monitoring efforts must comply with the requirements for sampling protocols and laboratory analytical methods identified in this MRP, including parameters listed in Table 3, or propose a functional equivalent that meets the same objectives and purposes as individual groundwater monitoring. The cooperative groundwater monitoring program must report results consistent with individual groundwater reporting defined in Part 2.B., or report results in a manner that is consistent with that approved by the Executive Officer in his or her approval of the cooperative groundwater monitoring proposal. Dischargers electing to participate in a cooperative groundwater monitoring

effort must convey this election to the Central Coast Water Board **by August 1, 2012**, and the individual groundwater monitoring requirements shall not apply as long as a cooperative groundwater monitoring proposal for that Discharger's area is submitted within one (1) year of adoption of this Order. If no cooperative groundwater monitoring proposal for that Discharger's area is submitted within one (1) year, then the individual groundwater monitoring provisions shall apply and the Discharger shall have one (1) year to comply with the provisions identified in Part 2.

B. Individual Groundwater Reporting

1. **By October 1, 2013 and annually thereafter by October 1**, Tier 3 Dischargers must submit groundwater monitoring results and information, electronically, in a format specified by the Executive Officer. Dischargers must include the following information:
   a. Signed transmittal letter;
   b. Number of groundwater wells present at each farm/ranch;
   c. Identification of any groundwater wells abandoned or destroyed (including method destroyed) in compliance with the Order;
   d. Owner-assigned well identification;
   e. State identification number, if available;
   f. Well location (latitude and longitude);
   g. Water-use category (e.g., domestic drinking water, agricultural);
   h. Identification of primary irrigation well;
   i. Well construction information (e.g., total depth, screened intervals, depth to water), as available;
   j. Use for fertigation or chemigation;
   k. Presence and type of back flow prevention devices;
   l. Photo-documentation of well condition and back flow prevention device **(photos must be maintained in the Farm Plan and submitted upon request of the Executive Officer);**
   m. Identification of wells sampled to comply with the Order and MRP;
   n. Laboratory data must be compatible with the Water Board's Groundwater Ambient Monitoring and Assessment (GAMA) Program, and GeoTracker electronic deliverable format (EDF).

Note: The above information (a-n) is reported electronically in the Notice of Intent and groundwater reporting to the GeoTracker data management system. t is not necessary for Dischargers to prepare and submit a separate technical report that includes this information.

C. Nitrate Loading Risk Factor Determination and Total Nitrogen Reporting

1. Tier 3 Dischargers must calculate the nitrate loading risk factor for each ranch/farm included in their operations. The nitrate loading risk factor is a measure of the relative risk of loading nitrate to groundwater. Tier 3 Dischargers must determine the nitrate loading risk factor for each ranch/farm, based on the highest risk activity existing at each ranch/farm. For example, if a Discharger uses both sprinkler and drip irrigation on the same crop, they must use the irrigation type "sprinkler" in the nitrate loading risk calculation. To calculate nitrate loading risk, Tier 3 Dischargers must use the criteria and methodology described in Table 4 of this MRP, or use the Nitrate Groundwater Pollution Hazard Index developed by University of California Division of Agriculture and Natural Resources (UCANR).

2. Tier 3 Dischargers may choose to subdivide the ranch/farm into "nitrate loading risk units," based on the variability of ranch/farm conditions for the purposes of complying with this Order. A nitrate loading risk unit is a subdivided unit of the ranch/farm with different farming conditions (irrigation system type, crop type, nitrate concentration in the irrigation water, etc.). The nitrate loading risk unit may be the total ranch, a number of blocks, or an individual block. If a Discharger chooses to subdivide the ranch/farm into individual nitrate loading risk units, the Discharger must maintain individual record keeping, and conduct monitoring and reporting for each nitrate loading risk unit.

3. Tier 3 Dischargers who choose to evaluate nitrate loading risk using the Table 4 criteria and methodology must calculate the ranch/farm or nitrate loading risk unit's nitrate loading risk level (low, moderate, or high), as described in Table 4. Dischargers must report Nitrate Loading Risk factors and level in the electronic Annual Compliance Form.
    a. LOW - Nitrate loading risk is less than 10;
    b. MODERATE – Nitrate loading risk is between 10 and 15;
    c. HIGH – Nitrate loading risk is more than 15;

4. Tier 3 Dischargers who choose to evaluate nitrate loading risk using the Nitrate Groundwater Pollution Hazard Index must characterize the soil type for the individual farm(s), including any variability in soil type, and utilize the index tool at the Internet link below. Soil types may vary across individual fields, and this variability must be accounted for when using the Nitrate Groundwater Pollution Hazard Index. If the soil type is unknown or if the soil type is not included in the UCANR Nitrate Groundwater Pollution Hazard Index tool, Dischargers must use the Table 4 criteria and methodology described above. Dischargers must provide documentation of input to the index for crop type, soil type, irrigation type, and deep rip. A

resulting Nitrate Groundwater Pollution Hazard Index number greater than or equal to 20 indicates a High Nitrate Loading Risk.

http://ucanr.org/sites/wrc/Programs/Water_Quality/Nitrate_Groundwater_Pollution_Hazard_Index/"

5. Tier 3 Dischargers with individual farms/ranches or nitrate loading risk units that have a HIGH nitrate loading risk must report total nitrogen applied per crop, per acre, per year to each farm/ranch or nitrate loading risk unit in the electronic Annual Compliance Form. Total nitrogen must be reported in units of nitrogen, for any product, form or concentration including, but not limited to, organic and inorganic fertilizers, slow release products, compost, compost teas, manure, extracts, nitrogen present in the soil, and nitrate in irrigation water;
    a. As an alternative to reporting total nitrogen, Tier 3 Dischargers with high nitrate loading risk may propose an individual discharge groundwater monitoring and reporting program (GMRP) plan for approval by the Executive Officer. The GMRP plan must evaluate waste discharge to groundwater from each ranch/farm or nitrate loading risk unit and assess if the waste discharge is of sufficient quality that it will not cause or contribute to exceedances of any nitrate water quality standards in groundwater.

PART 3. ANNUAL COMPLIANCE FORM

Tier 3 Dischargers must submit annual compliance information, electronically, in a format specified by the Executive Officer. The purpose of the electronic Annual Compliance Form is to provide information to the Central Coast Water Board to assist in the evaluation of threat to water quality from individual agricultural discharges of waste and measure progress towards water quality improvement and verify compliance with the Order and MRP. Time schedules are shown in Table 6.

A. Annual Compliance Form

1. **By October 1, 2012 and updated annually thereafter by October 1**, Tier 3 Dischargers must submit an Annual Compliance Form electronically, in a format specified by the Executive Officer. The electronic Annual Compliance Form includes, but is not limited to the following minimum requirements[3]:
    a. Signed transmittal letter;

[3] Items reported in the Annual Compliance Form are due by October 1, 2012 and annually thereafter, unless otherwise specified.

b. Verification that any change in general operation or farm/ranch information (e.g., crop type, irrigation type, discharge type) is reported on update to Notice of Intent (NOI);
c. Verification of compliance with monitoring requirements, including any cooperative monitoring fees;
d. Verification of completed Farm Plan and date of last update;
e. Information regarding type and characteristics of discharge (e.g., number of discharge points, estimated flow/volume, number of tailwater days);
f. Identification of any direct agricultural discharges to a stream, lake, estuary, bay, or ocean;
g. Identification of specific farm water quality management practices completed, in progress, and planned to address water quality impacts caused by discharges of waste including irrigation management, pesticide management, nutrient management, salinity management, stormwater management, and sediment and erosion control to achieve compliance with this Order;
h. Nitrate concentration of irrigation water;
i. Identification of the application of any fertilizers, pesticides, fumigants or other chemicals through an irrigation system (e.g. fertigation or chemigation) and proof of proper backflow prevention devices;
j. Description of method and location of chemical applications relative to surface water;
k. Nitrate Loading Risk factors in Table 4 or Nitrate Groundwater Pollution Hazard Index input and Nitrate Loading Risk level;
l. Proof of approved California Department of Fish and Game (CDFG) Streambed Alteration Agreement, as required by CDFG for any work proposed within the bed, bank or channel of a lake or stream, including riparian areas, that has the potential to result in erosion and discharges of waste to waters of the State;

Tier 3 Dischargers with farms/ranches that contain or are adjacent to a waterbody impaired for temperature, turbidity or sediment:

m. Photo monitoring to document condition of streams, riparian, and wetland area habitat and the presence of bare soil within the riparian habitat area that is vulnerable to erosion;
n. Water Quality Buffer Plan or alternative[4];

Tier 3 Dischargers with farms/ranches that have High Nitrate Loading Risk:

o. Total nitrogen applied per acre to each farm/ranch or nitrate loading risk unit (in units of nitrogen, in any product, form or

[4] Due by October 1, 2016

concentration) including, but not limited to, organic and inorganic fertilizers, slow release products, compost, compost teas, manure, extracts, nitrogen present in the soil, and nitrate in irrigation water[5];

p. Specific elements of the INMP (e.g., Proof of certification, Crop Nitrogen Uptake Values, Nitrogen Balance Ratio, Estimate of Nitrate Loading to Groundwater, Estimate of Reduction in Nitrate Loading to Groundwater)[6];

q. INMP Effectiveness Report[7]

PART 4. PHOTO MONITORING AND REPORTING REQUIREMENTS

Photo monitoring and reporting requirements identified in Part 4.A. apply to Tier 3 Dischargers that have <u>farms/ranches that contain or are adjacent to a waterbody identified on the List of Impaired Waterbodies as impaired for temperature, turbidity or sediment (see Order Table 1).</u> Time schedules are shown in Table 6.

A. Photo Monitoring and Reporting

1. **By October 1, 2012**, Tier 3 Dischargers that have farms/ranches that contain or are adjacent to a waterbody *impaired for temperature, turbidity or sediment* must conduct photo monitoring to do the following:

    a. Document the existing condition of perennial, intermittent or ephemeral streams (wet or dry), riparian or wetland area habitat; Photo monitoring of existing conditions must be repeated every four years.

2. Tier 3 Dischargers must conduct photo monitoring consistent with protocol established by the Executive Officer. Dischargers must include date of photo, photo location and point of reference in the photo. Photos must be accompanied by explanations and descriptions of the management practices demonstrated in the photos to meet the Basin Plan requirements specified in Part 7.A. and must include estimated widths of riparian areas from top of bank.

3. **Tier 3 Dischargers must maintain photos in the Farm Plan and submit upon request of the Executive Officer.**

[5] Due by October 1, 2014 and annually thereafter by October 1.
[6] Due by October 1, 2015
[7] Due by October 1, 2016

PART 5. INDIVIDUAL SURFACE WATER DISCHARGE MONITORING AND REPORTING REQUIREMENTS

Monitoring and reporting requirements for individual surface water discharge identified in Part 5.A. and Part 5.B. apply to all Tier 3 Dischargers. Key monitoring and reporting requirements for individual surface water discharge are shown in Tables 5A and 5B. Time schedules are shown in Table 6.

A. Individual Surface Water Discharge Monitoring

2. Tier 3 Dischargers must conduct individual surface water discharge monitoring to a) evaluate the quality of individual waste discharges, including concentration and load of waste (in kilograms per day) for appropriate parameters, b) evaluate effects of waste discharge on water quality and beneficial uses, and c) evaluate progress towards compliance with water quality improvement milestones in the Order.

Individual Sampling and Analysis Plan

3. **By March 15, 2013**, Tier 3 Dischargers must submit an individual surface water discharge Sampling and Analysis Plan and QAPP to monitor individual discharges of waste from their farm/ranch, including irrigation run-off (including tailwater discharges and discharges from tile drains, tailwater ponds and other surface water containment features unless constructed with impermeable liner), and stormwater discharges. The Sampling and Analysis Plan and QAPP must be submitted to the Executive Officer.

4. The Sampling and Analysis Plan must include the following minimum required components to monitor irrigation run-off, including tailwater discharges and discharges from tile drains, tailwater ponds and other surface water containment features, and stormwater discharges:
    a. Number and location of discharge points (identified with latitude and longitude or on a scaled map);
    b. Number and location of monitoring points;
    c. Description of typical irrigation runoff patterns;
    d. Map of discharge and monitoring points;
    e. Sample collection methods;
    f. Monitoring parameters;
    g. Monitoring schedule and frequency of monitoring events;

5. The QAPP must include appropriate methods for sampling, measurement and analysis, data collection or generation, data handling, quality control activities, and documentation.

6. The Sampling and Analysis Plan and QAPP, and any proposed revisions are subject to approval by the Executive Officer. The Executive Officer may require modifications to the Sampling and Analysis Plan or Tier 3 Dischargers may propose Sampling and Analysis Plan modifications for Executive Officer approval, when modifications are justified to accomplish the objectives of the MRP.

Individual Surface Water Discharge Monitoring Points

7. Tier 3 Dischargers must select monitoring points to characterize at least 80% of the estimated irrigation run-off discharge volume from each farm/ranch at the point in time the sample is taken[8], including tailwater discharges and discharges from tile drains. Sample must be taken when irrigation activity is causing maximal run-off. Load estimates will be generated by multiplying flow volume of discharge by concentration of contaminants. Tier 3 Dischargers must include at least one monitoring point from each farm/ranch which drains areas where chlorpyrifos or diazinon are applied, and monitoring of runoff or tailwater must be conducted within one week of chemical application. If discharge is not routinely present, Discharger may characterize typical run-off patterns in the Annual Report. See Table 4a for additional details.

8. Tier 3 Dischargers must also monitor tailwater ponds and other surface water containment features. If multiple ponds are present, sampling must cover at least 80% by volume of the containment features. See Table 4b for additional details.

Individual Surface Water Discharge Monitoring Parameters, Frequency, and Schedule

9. Tier 3 Dischargers must conduct monitoring for parameters, laboratory analytical methods, frequency and schedule described in Tables 4A and 4B. Dischargers may utilize in-field water testing instruments/equipment as a substitute for laboratory analytical methods if the method is approved by U.S. EPA, meets reporting limits (RL) and practical quantitation limits (PQL) specifications in the MRP, and appropriate sampling methodology and quality assurance checks can be applied to ensure that QAPP standards are met to ensure accuracy of the test.

10. **By October 1, 2013** of the adoption of the Order, Tier 3 Dischargers must initiate individual surface water discharge monitoring per the Sampling and

[8] The requirement to select monitoring points to characterize at least 80% of the estimated irrigation run-off is for the purposes of collecting a sample that represents a majority of the volume of irrigation run-off discharged. The MRP does not specify the number or location of monitoring points to provide maximum flexibility for growers to determine how many sites are necessary and exact locations given site-specific conditions.

Analysis Plan and QAPP, unless otherwise directed by the Executive Officer.

B. Individual Surface Water Discharge Reporting

Individual Surface Water Discharge Monitoring Data Submittal

1. **By March 15, 2014,** October 1, 2014, and annually thereafter by October 1, Tier 3 Dischargers must submit individual surface water discharge monitoring data to the Central Coast Water Board electronically, in a format specified by the Executive Officer. The electronic data submittal must include the following minimum information:

   a. Electronic laboratory data submitted;
   b. Narrative description of typical irrigation runoff patterns;
   c. Location of sampling sites and map(s);
   d. Sampling and analytical methods used;
   e. Specify the method used to obtain flow at each monitoring site during each monitoring event;
   f. Photos obtained from all monitoring sites, clearly labeled with location and date;
   g. Sample chain-of-custody forms do not need to be submitted but must be made available to Central Coast Water Board staff, upon request;

PART 6. IRRIGATION AND NUTRIENT MANAGEMENT PLAN

Monitoring and reporting requirements related to the Irrigation and Nutrient Management Plan (INMP) identified in Part 6.A., 6.B., and 6.C. apply to Tier 3 Dischargers that have farms/ranches with high nitrate loading risk. Time schedules are shown in Table 6.

A. Irrigation and Nutrient Management Plan Monitoring

1. Tier 3 Dischargers with High Nitrate Loading Risk must develop and initiate implementation of an Irrigation and Nutrient Management Plan (INMP) certified by a Professional Soil Scientist, Professional Agronomist, or Crop Advisor certified by the American Society of Agronomy, or similarly qualified professional.

2. The purpose of the INMP is to budget and manage the nutrients applied to each farm/ranch or nitrate loading risk unit considering all sources of nutrients, crop requirements, soil types, climate, and local conditions in

order to minimize nitrate loading to surface water and groundwater in compliance with this Order.

3. The professional certification of the INMP must indicate that the relevant expert has reviewed all necessary documentation and testing results, evaluated nutrient balance calculations (total nitrogen applied relative to typical crop nitrogen uptake and nitrogen removed at harvest), evaluated estimated nitrate loading to groundwater, evaluated progress towards nutrient management targets, and conducted field verification to ensure accuracy of reporting.

4. Tier 3 Dischargers with High Nitrate Loading Risk must include the following elements in the INMP. The INMP is not submitted to the Central Coast Water Board, with the exception of key elements identified in Part 6B:
    a. Proof of INMP certification;
    b. Map locating each farm/ranch or nitrate loading risk unit;
    c. Identification of nitrate loading risk factors or input to the Groundwater Pollution Nitrate Hazard Index and overall Nitrate Loading Risk level calculation for each ranch/farm or nitrate loading risk unit;
    d. Identification of crop nitrogen uptake values for use in nutrient balance calculations;
    e. Record keeping of the total nitrogen applied per crop, per acre to each farm/ranch or nitrate loading risk unit (in units of nitrogen, in any product, form or concentration) including, but not limited to, organic and inorganic fertilizers, slow release products, compost, compost teas, manure, extracts, nitrogen present in the soil, and nitrate in irrigation water;
    f. Dischargers must take a nitrogen soil sample (e.g. laboratory analysis or nitrate quick test) or use an alternative method to evaluate nitrogen content in soil, prior to planting or seeding the field or prior to the time of pre-sidedressing. The amount of nitrogen remaining in the soil must be accounted for as a source of nitrogen when budgeting, and the soil sample or alternative method results must be maintained in the INMP.
    g. Annual balance of nitrogen applied compared to typical crop nitrogen uptake for each ranch/farm or nitrate loading risk unit (Nitrogen Balance ratio);
    h. Annual estimation of nitrogen loading to groundwater and surface water, including subsurface drainage (e.g., tile drains), from each ranch/farm or nitrate loading risk unit;
    i. Identification of irrigation and nutrient management practices in progress (identify start date), completed (identify completion date), and planned (identify anticipated start date) to reduce

nitrate loading to groundwater to achieve compliance with this Order.

j. Annual evaluation of reductions in nitrate loading to groundwater resulting from decreased fertilizer use and/or implementation of irrigation and nutrient management practices;
k. Description of methods Discharger will use to verify overall effectiveness of the INMP.

5. Tier 3 Dischargers must evaluate the effectiveness of the INMP. Irrigation and Nutrient Management Plan effectiveness monitoring must be conducted or supervised by a registered professional engineer, professional geologist, Certified Crop Advisor, or similarly qualified professional. Monitoring must evaluate measured progress towards protecting, preserving, and restoring groundwater quality in the upper-most aquifer (or perched aquifer, whichever is first encountered), resulting from reductions in loading based on reduced fertilizer use and improved irrigation and nutrient management practices. Monitoring methods used may include, but are not limited to lysimeter monitoring, shallow groundwater or soil monitoring, or groundwater well monitoring. If the physical monitoring by itself cannot demonstrate progress towards compliance with the Order, the Discharger may need to supplement physical monitoring with contaminant transport and flow modeling.

B. Irrigation and Nutrient Management Plan Reporting

1. **By October 1, 2015 and annually thereafter,** Tier 3 Dischargers with High Nitrate Loading Risk must report the following INMP elements in the electronic Annual Compliance Form:
   a. Identification of crop nitrogen uptake values for use in nutrient balance calculations;
   b. Annual balance of nitrogen applied per crop compared to typical crop nitrogen uptake for each ranch/farm or nitrate loading risk unit (Nitrogen Balance ratio);
   c. Annual estimation of nitrogen loading to groundwater and surface water, including subsurface drainage (e.g., tile drains), from each ranch/farm or nitrate loading risk unit;
   d. Annual evaluation of reductions in nitrate loading to groundwater resulting from decreased fertilizer use and/or implementation of nutrient management practices;

2. **By October 1, 2016**, Tier 3 Dischargers that have farms/ranches with high nitrate loading risk to groundwater must submit an INMP Effectiveness Report to evaluate measured progress towards protecting, preserving, and restoring groundwater quality in the upper-most aquifer, including reductions in loading based on the implementation of irrigation and nutrient

management practices. The INMP Effectiveness Report must be prepared by a state registered professional engineer, professional geologist, Certified Crop Advisor, or similarly qualified professional. Dischargers in the same groundwater basin or subbasin may choose to comply with this requirement as a group by submitting a single report that evaluates the overall effectiveness of the broad scale implementation of irrigation and nutrient management practices identified in individual INMPs to protect groundwater and achieve water quality standards for nitrate. Group efforts must use data from each farm/ranch (e.g., individual groundwater wells, lysimeters, and/or soil samples) to adequately represent groundwater quality and progress towards groundwater protection for all farms/ranches in the group. The INMP Effectiveness Report must include the following elements and submitted with the electronic Annual Compliance Form:

a. A description of the methodology used to evaluate and verify effectiveness of the INMP (e.g., lysimeter monitoring, shallow groundwater or soil monitoring, groundwater well monitoring, contaminant transport and flow modeling);
b. An evaluation of how discharges of waste and any associated reductions in nitrate loading will decrease the concentration of nitrate in the upper-most aquifer, commensurate with water quality standards, within a reasonable and foreseeable time frame, and compared to milestones identified in the Order;
c. Based on estimated nitrate loading reductions to the groundwater basin or subbasin, the estimated number of years to achieve water quality standards in receiving water;

PART 7. WATER QUALITY BUFFER PLAN

Monitoring and reporting requirements related to the Water Quality Buffer Plan identified in Part 7.A. and Part 7.B. apply to Tier 3 Dischargers that have farms/ranches *that contain or are adjacent to waterbody identified on the List of Impaired Waterbodies as impaired for temperature, turbidity, or sediment).* Time schedules are shown in Table 6.

A. **Water Quality Buffer Plan***;*

1. **By October 1, 2016**, Tier 3 Dischargers adjacent to or containing a waterbody identified on the List of Impaired Waterbodies as impaired for temperature, turbidity or sediment must submit a Water Quality Buffer Plan to the Executive Officer that protects the listed waterbody and its associated perennial and intermittent tributaries. The purpose of the Water Quality Buffer Plan is to prevent waste discharge, comply with water quality standards (e.g., temperature, turbidity, sediment), and protect beneficial

uses in compliance with this Order and the following Basin Plan requirement:

Basin Plan (Chapter 5, p. V-13, Section V.G.4 – Erosion and Sedimentation, *"A filter strip of appropriate width, and consisting of undisturbed soil and riparian vegetation or its equivalent, must be maintained, wherever possible, between significant land disturbance activities and watercourses, lakes, bays, estuaries, marshes, and other water bodies. For construction activities, minimum width of the filter strip must be thirty feet, wherever possible…."*

2. The Water Quality Buffer Plan must include the following or the functional equivalent, to address discharges of waste and associated water quality impairments:

   a. A minimum 30 foot buffer (as measured horizontally from the top of bank on either side of the waterway, or from the high water mark of a lake and mean high tide of an estuary);
   b. Any necessary increases in buffer width to adequately prevent the discharge of waste that may cause or contribute to any excursion above or outside the acceptable range for any Regional, State, or Federal numeric or narrative water quality standard (e.g., temperature, turbidity);
   c. Any buffer less than 30 feet must provide equivalent water quality protection and be justified based on an analysis of site-specific conditions and be approved by the Executive Officer;
   d. Identification of any alternatives implemented to comply with this requirement, that are functionally equivalent to described buffer;
   e. Schedule for implementation;
   f. Maintenance provisions to ensure water quality protection;
   g. Annual photo monitoring to be included in the Annual Compliance Form;

PART 8. GENERAL MONITORING AND REPORTING REQUIREMENTS

A. Submittal of Technical Reports

1. Dischargers must submit reports in a format specified by the Executive Officer (reports will be submitted electronically, unless otherwise specified by the Executive Officer). A transmittal letter must accompany each report, containing the following penalty of perjury statement signed by the Discharger or the Discharger's authorized agent:

   "In compliance with Water Code §13267, I certify under penalty of perjury that this document and all attachments were prepared by me, or under my

direction or supervision following a system designed to assure that qualified personnel properly gather and evaluate the information submitted. To the best of my knowledge and belief, this document and all attachments are true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment".

2. If the Discharger asserts that all or a portion of a report submitted pursuant to this Order is subject to an exemption from public disclosure (e.g. trade secrets or secret processes), the Discharger must provide an explanation of how those portions of the reports are exempt from public disclosure. The Discharger must clearly indicate on the cover of the report (typically an electronic submittal) that the Discharger asserts that all or a portion of the report is exempt from public disclosure, submit a complete report with those portions that are asserted to be exempt in redacted form, submit separately (in a separate electronic file) unredacted pages (to be maintained separately by staff). The Central Coast Water Board staff will determine whether any such report or portion of a report qualifies for an exemption from public disclosure. If the Central Coast Water Board staff disagrees with the asserted exemption from public disclosure, the Central Coast Water Board staff will notify the Discharger prior to making such report or portions of such report available for public inspection. In the interest of public health and safety, the Central Coast Water Board will not make available for public inspection, the precise location of any groundwater well monitored in compliance with this Order. Consistent with the reporting of groundwater wells on GeoTracker, groundwater well location and data will only be referenced within a one-half mile radius of the actual well location.

B. Enforcement and Violations

1. Monitoring reports are required pursuant to Section 13267 of the California Water Code. Pursuant to Section 13268 of the Water Code, a violation of a request made pursuant to Section 13267 may subject you to civil liability assessment of up to $1000 per day.

C. Executive Officer Authority

1. The Executive Officer may revise this MRP as necessary, and Dischargers must comply with the MRP as revised by the Executive Officer. Specifically, the Executive Officer may increase monitoring and reporting requirements where monitoring results, pesticide use patterns, or other indicators suggest that the increase is warranted due to an increased threat to water quality. Additionally, the Executive Officer can reduce monitoring and reporting requirements, including adjusting time schedules, where growers are coordinating efforts at watershed or subwatershed scales or where regional

treatment facilities are implemented, or other indicators suggest that the reduction is warranted due to a reduced threat to water quality.

____
for Kenneth Harris, Jr.
Interim Acting Executive Officer

August 10, 2012
____
Date

Table 1. Major Waterbodies in Agricultural Areas[1]

Hydrologic SubArea	Waterbody Name	Hydrologic SubArea	Waterbody Name
30510	Pajaro River	30920	Quail Creek
30510	Salsipuedes Creek	30920	Salinas Reclamation Canal
30510	Watsonville Slough	31022	Chorro Creek
30510	Watsonville Creek[2]	31023	Los Osos Creek
30510	Beach Road Ditch[2]	31023	Warden Creek
30530	Carnadero Creek	31024	San Luis Obispo Creek
30530	Furlong Creek[2]	31024	Prefumo Creek
30530	Llagas Creek	31031	Arroyo Grande Creek
30530	Miller's Canal	31031	Los Berros Creek
30530	San Juan Creek	31210	Bradley Canyon Creek
30530	Tesquisquita Slough	31210	Bradley Channel
30600	Moro Cojo Slough	31210	Green Valley Creek
30910	Alisal Slough	31210	Main Street Canal
30910	Blanco Drain	31210	Orcutt Solomon Creek
30910	Old Salinas River	31210	Oso Flaco Creek
30910	Salinas River (below Gonzales Rd.)	31210	Little Oso Flaco Creek
30920	Salinas River (above Gonzales Rd. and below Nacimiento R.)	31210	Santa Maria River
30910	Santa Rita Creek[2]	31310	San Antonio Creek[2]
30910	Tembladero Slough	31410	Santa Ynez River
30920	Alisal Creek	31531	Bell Creek
30920	Chualar Creek	31531	Glenn Annie Creek
30920	Espinosa Slough	31531	Los Carneros Creek[2]
30920	Gabilan Creek	31534	Arroyo Paredon Creek
30920	Natividad Creek	31534	Franklin Creek

[1] At a minimum, sites must be included for these waterbodies in agricultural areas, unless otherwise approved by the Executive Officer. Sites may be proposed for addition or modification to better assess the impacts of waste discharges from irrigated lands to surface water. Dischargers choosing to comply with surface receiving water quality monitoring, individually (not part of a cooperative monitoring program) must only monitor sites for waterbodies receiving the discharge.

[2] These creeks are included because they are newly listed waterbodies on the 2010 303(d) list of Impaired Waters that are associated with areas of agricultural discharge.

Table 2. Surface Receiving Water Quality Monitoring Parameters

Parameters and Tests	RL[3]	Monitoring Frequency[1]
Photo Monitoring		
Upstream and downstream photographs at monitoring location		With every monitoring event
WATER COLUMN SAMPLING		
Physical Parameters and General Chemistry		
Flow (field measure) (CFS) following SWAMP field SOP[9]	.25	Monthly, including 2 stormwater events
pH (field measure)	0.1	”
Electrical Conductivity (field measure) (uS/cm)	2.5	”
Dissolved Oxygen (field measure) (mg/L)	0.1	”
Temperature (field measure) (^oC)	0.1	”
Turbidity (NTU)	0.5	”
Total Dissolved Solids (mg/L)	10	”
Total Suspended Solids (mg/L)	0.5	”
Nutrients		
Total Nitrogen (mg/L)	0.5	Monthly, including 2 stormwater events
Nitrate + Nitrite (as N) (mg/L)	0.1	”
Total Ammonia (mg/L)	0.1	”
Unionized Ammonia (calculated value, mg/L))		”
Total Phosphorus (as P) (mg/L)	-	”
Soluble Orthophosphate (mg/L)	0.01	”
Water column chlorophyll a (mg/L)	0.002	“
Algae cover, Floating Mats, % coverage	-	“
Algae cover, Attached, % coverage	-	“
Water Column Toxicity Test		
Algae -*Selenastrum capricornutum, 4 day*	-	Twice in dry season, twice in wet season
Water Flea – *Ceriodaphnia (7-day chronic)*	-	”
Fathead Minnow - *Pimephales promelas (7-day chronic)*	-	”
Toxicity Identification Evaluation (TIE)	-	As directed by Executive Officer
Pesticides[2] (ug/L)		
Carbamates		
Aldicarb	0.05	4 times, concurrent with water toxicity monitoring, in second year of Order term

Parameters and Tests	RL[3]	Monitoring Frequency[1]
Carbaryl	0.05	”
Carbofuran	0.05	”
Methiocarb	0.05	”
Methomyl	0.05	”
Oxamyl	0.05	”
Organophosphate Pesticides		
Azinphos-methyl	0.02	”
Chlorpyrifos	0.005	”
Diazinon	0.005	”
Dichlorvos	0.01	”
Dimethoate	0.01	”
Dimeton-s	0.005	”
Disulfoton (Disyton)	0.005	”
Malathion	0.005	”
Methamidophos	0.02	”
Methidathion	0.02	“
Parathion-methyl	0.02	“
Phorate	0.01	“
Phosmet	0.02	“
Herbicides		
Atrazine	0.05	“
Cyanazine	0.20	“
Diuron	0.05	“
Glyphosate	2.0	“
Linuron	0.1	“
Paraquat dichloride	4	“
Simazine	0.05	“
Trifluralin	0.05	“
Metals (ug/L)		
Arsenic (total) [5,7]	0.3	4 times, concurrent with water toxicity monitoring, in second year of Order term
Boron (total) [6,7]	10	“
Cadmium (total & dissolved) [4.5,7]	0.01	“
Copper (total and dissolved) [4,7]	0.01	“
Lead (total and dissolved) [4,7]	0.01	“
Nickel (total and dissolved) [4,7]	0.02	“
Molybdenum (total) [7]	1	“
Selenium (total)[7]	0.30	“
Zinc (total and dissolved) [4.5,7]	0.10	“
Other (ug/L)		
Total Phenolic Compounds[8]	10	4 times, concurrent with water toxicity monitoring, in second year of Order term
Hardness (mg/L as CaCO3)	1	“
Total Organic Carbon (ug/L)	0.6	“

Parameters and Tests	RL[3]	Monitoring Frequency[1]
SEDIMENT SAMPLING		
Sediment Toxicity - Hyalella azteca 10-day		Annually
Benthic Invertebrate and associated Physical Habitat Assessment	SWAMP SOP	Once during the second year of Order concurrent with sediment toxicity sampling
Pyrethroid Pesticides in Sediment (ug/kg)		
Gamma-cyhalothrin	2	Once during second year of Order, concurrent with sediment toxicity sampling
Lambda-cyhalothrin	2	
Bifenthrin	2	"
Beta-cyfluthrin	2	"
Cyfluthrin	2	"
Esfenvalerate	2	"
Permethrin	2	"
Cypermethrin	2	"
Danitol	2	"
Fenvalerate	2	"
Fluvalinate	2	"
Organochlorine Pesticides in Sediment		
DCPA	10	"
Dicofol	2	"
Other Monitoring in Sediment		
Chlorpyrifos (ug/kg)	2	"
Total Organic Carbon	0.01%	"
Sulfide		"
Sediment Grain Size Analysis	1%	"

[1]Monitoring is ongoing through all five years of the Order, unless otherwise specified. Monitoring frequency may be used as a guide for developing alternative Sampling and Analysis Plan.
[2]Pesticide list may be modified based on specific pesticide use in Central Coast Region. Analytes on this list must be reported, at a minimum.
[3] Reporting Limit, taken from SWAMP where applicable.
[4] Holmgren, Meyer, Cheney and Daniels. 1993. Cadmium, Lead, Zinc, Copper and Nickel in Agricultural Soils of the United States. J. of Environ. Quality 22:335-348.
[5]Sax and Lewis, ed. 1987. Hawley's Condensed Chemical Dictionary. 11th ed. New York: Van Nostrand Reinhold Co., 1987. Zinc arsenate is an insecticide.
[6]Http://www.coastalagro.com/products/labels/9%25BORON.pdf; Boron is applied directly or as a component of fertilizers as a plant nutrient.
[7]Madramootoo, Johnston, Willardson, eds. 1997. Management of Agricultural Drainage Water Quality. International Commission on Irrigation and Drainage. U.N. FAO. SBN 92-6-104058.3.
[8]http://cat.inist.fr/?aModele=afficheN&cpsidt=14074525; Phenols are breakdown products of herbicides and pesticides. Phenols can be directly toxic and cause endocrine disruption.
[9]See SWAMP field measures SOP, p. 17
mg/L – milligrams per liter; ug/L – micrograms per liter; ug/kg – micrograms per kilogram;
NTU – Nephelometric Turbidity Units; CFS – cubic feet per second;

Table 3. Groundwater Monitoring Parameters

Parameter	RL	Analytical Method[3]	Units
pH	0.1	Field or Laboratory Measurement EPA General Methods	pH Units
Specific Conductance	2.5		μS/cm
Total Dissolved Solids	10		mg/L
Total Alkalinity as $CaCO_3$	1	EPA Method 310.1 or 310.2	
Calcium	0.05	General Cations[1] EPA 200.7, 200.8, 200.9	
Magnesium	0.02		
Sodium	0.1		
Potassium	0.1		
Sulfate (SO_4)	1.0	General Anions EPA Method 300 or EPA Method 353.2	
Chloride	0.1		
Nitrate + Nitrite (as N)[2] *or* Nitrate as NO_3	0.1		

[2]General chemistry parameters (major cations and anions) represent geochemistry of water bearing zone and assist in evaluating quality assurance/quality control of groundwater monitoring and laboratory analysis.
[3]The MRP allows analysis of "nitrate plus nitrite" to represent nitrate concentrations. The "nitrate plus nitrite" analysis allows for extended laboratory holding times and relieves the Discharger of meeting the short holding time required for nitrate. Dischargers may also analyze for Nitrate as NO_3.
[4]Dischargers may use alternative analytical methods approved by EPA.
RL – Reporting Limit; μS/cm – micro siemens per centimeter

Table 4. Nitrate Loading Risk Factor Criteria and Risk Level Calculation

A. Crop Type Nitrate Hazard Index Rating

1 - Bean, Grapes, Olive.

2 - Apple, Avocado, Barley, Blackberry, Blueberry, Carrot, Chicory, Citrus, Lemon Oat, Orange, Peach, Pear, Pistachio, Raspberry, Walnut, Wheat.

3 - Artichoke, Bean, Brussel Sprout, Corn, Cucumber, Daikon, Peas, Radish, Squash, Summer, Tomato, Turnip, Squash, Rutabaga, Pumpkin, Potato.

4 – Beet, Broccoli, Cabbage, Cauliflower, Celery, Chinese Cabbage (Napa),Collard, Endive, Kale, Leek, Lettuce, Mustard, Onion, Parsley, Pepper, Spinach, Strawberry.

(Based on UC Riverside Nitrate Hazard Index)

B. Irrigation System Type Rating

1 - Micro-irrigation year round (drip and micro-sprinklers) and no pre-irrigation;

2 - Sprinklers used for pre-irrigation only and then micro-irrigation;

3 - Sprinklers used for germination or at any time during growing season;

4 - Surface irrigation systems (furrow or flood) at any, and/or in combination with any other irrigation system type;

(Based on UC Riverside Nitrate Hazard Index, Adapted for the Central Coast Region)

C. Irrigation Water Nitrate Concentration Rating

1 – Nitrate concentration 0 to 45 mg/liter Nitrate NO3
2 - Nitrate concentration 46 to 60 mg/liter Nitrate NO3
3 - Nitrate concentration 61to 100 mg/liter Nitrate NO3
4 - Nitrate concentration > 100 mg/l Nitrate NO3

D. Nitrate Loading Risk Level Calculation = A x B x C
LOW - Nitrate loading risk is less than 10;
MODERATE – Nitrate loading risk is between 10 and 15;
HIGH – Nitrate loading risk is more than 15;

Note: Dischargers must determine the nitrate loading risk factor for each ranch/farm, based on the criteria associated with the highest risk activity existing at each ranch/farm. For example, the ranch/farm is assigned the highest risk factor, based on the single highest risk crop in the rotation, on one block under furrow irrigation, or on one well with high nitrate concentration. As an alternative to the nitrate loading risk level calculation described in Table 4, Dischargers may use the Groundwater Pollution Nitrate Hazard Index developed by UCANR, where a resulting Nitrate Hazard Index score equal or greater or equal to 20 indicates a HIGH nitrate loading risk to groundwater.

Table 5A. Individual Discharge Monitoring for Tailwater, Tile drain, and Stormwater Discharges

Parameter	Analytical Method[1]	Maximum PQL	Units	Min Monitoring Frequency
Discharge Flow or Volume	Field Measure	---	CFS	(a) (d)
Approximate Duration of Flow	Calculation	---	hours/month	
Temperature (water)	Field Measure	0.1	^{o} Celsius	
pH	Field Measure	0.1	pH units	
Electrical Conductivity	Field Measure	100	µS/cm	
Turbidity	SM 2130B, EPA 180.1	1	NTUs	
Nitrate + Nitrite (as N)	EPA 300.1, EPA 353.2	0.1	mg/L	
Ammonia	SM 4500 NH3, EPA 350.3	0.1	mg/L	
Chlorpyrifos[2]	EPA 8141A, EPA 614	0.02	ug/L	(b) (c) (d)
Diazinon[2]				
Ceriodaphnia Toxicity (96-hr acute)	EPA-821-R-02-012	NA	% Survival	
Hyalella Toxicity in Water (10-day)	EPA-821-R-02-013	NA	% Survival	

[1] In-field water testing instruments/equipment as a substitute for laboratory analysis if the method is approved by EPA, meets RL/PQL specifications in the MRP, and appropriate sampling methodology and quality assurance checks can be applied to ensure that QAPP standards are met to ensure accuracy of the test.
[2]If chlorpyrifos or diazinon is used at the farm/ranch, otherwise does not apply. The Executive Officer may require monitoring of other pesticides based on results of downstream receiving water monitoring.
(a) Two times per year during primary irrigation season for farms/ranches less than or equal to 500 acres, and four times per year during primary irrigation season for farms/ranches greater than 500 acres. Executive Officer may reduce sampling frequency based on water quality improvements.
(b) Once per year during primary irrigation season for farms/ranches less than or equal to 500 acres, and two times per year during primary irrigation season for farms/ranches greater than 500 acres.

(c) Sample must be collected within one week of chemical application, if chemical is applied on farm/ranch;
(d) Once per year during wet season (October – March) for farms/ranches less than or equal to 500 acres, and two times per year during wet season for farms/ranches greater than 500 acres, within 18 hours of major storm events;
CFS – Cubic feet per second; NTU – Nephelometric turbidity unit; PQL – Practical Quantitation Limit;
NA – Not applicable

Table 5B. Individual Discharge Monitoring for Tailwater Ponds and other Surface Containment Features

Parameter	Analytical Method[1]	Maximum PQL	Units	Minimum Monitoring Frequency
Volume of Pond	Field Measure	1	Gallons	(a) (d)
Nitrate + Nitrite (as N)	EPA 300.1, EPA 353.2	50	mg/L	

[1] In-field water testing instruments/equipment as a substitute for laboratory analysis if the method is approved by EPA, meets RL/PQL specifications in the MRP, and appropriate sampling methodology and quality assurance checks can be applied to ensure that QAPP standards are met to ensure accuracy of the test.
(a) Four times per year during primary irrigation season; Executive Officer may reduce monitoring frequency based on water quality improvements.
(d) Two times per year during wet season (October – March, within 18 hours of major storm events)

Table 6. Tier 3 - Time Schedule for Key Monitoring and Reporting Requirements

REQUIREMENT	TIME SCHEDULE[1]
Submit Quality Assurance Project Plan and Sampling And Analysis Plan for Surface Receiving Water Quality Monitoring (individually or through cooperative monitoring program)	Within three months
Initiate surface receiving water quality monitoring (individually or through cooperative monitoring program)	Within six months
Submit surface receiving water quality monitoring data (individually or through cooperative monitoring program)	Within nine months, quarterly thereafter (January 1, April 1, July 1, and October 1)
Submit surface receiving water quality Annual Monitoring Report (individually or through cooperative monitoring program)	Within one year, annually thereafter by January 1
Initiate monitoring of groundwater wells	Within one year
Submit individual surface water discharge Sampling and Analysis Plan	March 15, 2013
Initiate individual surface water discharge monitoring	October 1, 2013
Submit individual surface water discharge monitoring data	March 15, 2014, October 1, 2014 and annually thereafter by October 1
Submit electronic Annual Compliance Form	October 1, 2012, and updated annually thereafter by October 1
Submit groundwater monitoring results	October 1, 2013
Tier 3 Dischargers with farms/ranches that contain or are adjacent to a waterbody impaired for temperature, turbidity or sediment:	
Conduct photo monitoring of riparian or wetland area habitat	October 1, 2012, and every four years thereafter by October 1

Submit Water Quality Buffer Plan or alternative	October 1, 2016
Tier 3 Dischargers with farms/ranches that have High Nitrate Loading Risk:	
Report total nitrogen applied per acre to each farm/ranch or nitrate loading risk unit, in electronic Annual Compliance Form	October 1, 2014, and annually thereafter by October 1.
Determine Crop Nitrogen Uptake	October 1, 2013
Submit INMP elements in electronic Annual Compliance Form	October 1, 2015, and annually thereafter by October 1
Submit indication of progress towards Nitrogen Balance Ratio milestone equal to one (1) for crops in annual rotation (e.g. cool season vegetables) or alternative,	October 1, 2015
Submit indication of progress towards Nitrogen Balance Ratio milestone equal to 1.2 for annual crops occupying the ground for the entire year (e.g. strawberries or raspberries) or alternative	
Submit INMP Effectiveness Report	October 1, 2016

[1] Dates are relative to adoption of this Order, unless otherwise specified.

Exhibit 2

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION
895 AEROVISTA PLACE, SUITE 101
SAN LUIS OBISPO, CALIFORNIA 93401

Order No. R3-2004-0117

Conditional Waiver of Waste Discharge Requirements for Discharges From Irrigated Lands

The Central Coast Regional Water Quality Control Board finds:

1. The intent of this Conditional Waiver is to regulate discharges from irrigated lands to ensure that such discharges are not causing or contributing to exceedances of any Regional, State, or Federal numeric or narrative water quality standard. Irrigated lands are lands where water is applied for producing commercial crops and, for the purpose of this program, include, but are not limited to, land planted to row, vineyard, field and tree crops as well as commercial nurseries, nursery stock production and greenhouse operations with soil floors that are not currently operating under Waste Discharge Requirements (WDRs). Fully contained greenhouse operations (those that have no groundwater discharge due to impervious floors) are not covered under this Conditional Waiver and must either eliminate all surface water discharges of pollutants or apply for Waste Discharge Requirements. Lands that are planted to commercial crops that are not yet marketable, such as vineyards and tree crops, must also obtain coverage under this Conditional Waiver.

2. Discharges include surface discharges (also known as irrigation return flows or tailwater), subsurface drainage generated by installing drainage systems to lower the water table below irrigated lands (also known as tile drains), discharges to groundwater through percolation, and storm water runoff flowing from irrigated lands. These discharges can contain wastes that could affect the quality of waters of the state.

3. Discharger means the owner and/or operator of irrigated cropland on or from which there are discharges of waste that could affect the quality of any surface water or groundwater.

4. The Central Coast Region has approximately 600,000 acres of cropland under irrigation and more than 2,500 operations that are or may be discharging waste that could affect the quality of waters of the state.

5. Waters of the state is defined in Section 13050 of the California Water Code to be any surface or groundwater within the boundaries of the state.

6. Whether an individual discharge of waste from irrigated lands may affect the quality of waters of the state depends on the quantity of the discharge, quantity of the waste, the quality of the waste, the extent of treatment, soil characteristics, distance to surface water, depth to groundwater, crop type, management practices and other site-specific factors.

7. Waste discharges from some agricultural operations have and will continue to threaten the quality of the waters of the state, as shown by the number of water bodies on the Clean Water Act Section 303(d) list of impaired water bodies that identify agriculture as a potential source, particularly in the Central Coast Region.

8. Data collected through the Central Coast Ambient Monitoring Program and other monitoring identify water quality problems in areas of irrigated agriculture throughout the Region, including in groundwater.

9. California Water Code Section 13269 allows Regional Boards to waive submission of Reports of Waste Discharge (ROWDs) and/or issuance of Waste Discharge Requirements (WDRs) if it is in the public interest. On April 15, 1983, the Regional Board approved a policy allowing waivers of WDRs for 26 categories of discharges, including irrigation return flows and non-NPDES storm water runoff.

10. On October 10, 1999, Senate Bill 390 amended California Water Code Section 13269. The amendments extended all waivers in effect on January 1, 2000, for three years to January 1, 2003, unless terminated earlier, and required all existing waivers to expire on January 1, 2003, unless renewed.

11. As amended, CWC Section 13269 authorizes the Regional Board to waive WDRs for a specific discharge or specific types of discharges if the following conditions are met: 1) the waiver is in the public interest, 2) the waiver is conditional, 3) waiver conditions include performance of individual, group, or watershed-based monitoring, except for discharges that the Regional Board determines do not pose a significant threat to water quality, 4) compliance with waiver conditions is required, and 5) a public hearing has been held. The term of a waiver cannot exceed five years, but the Regional Board can renew a waiver after holding a public hearing. The Regional Board may terminate a waiver at any time.

12. The Regional Board, in compliance with amended CWC Section 13269, reviewed the previously issued categorical waivers for irrigation return flows and non-NPDES storm water runoff and determined that additional conditions are required to protect water quality.

13. Relevant factors in determining whether a waiver is in the public interest include the following: whether the discharge is already regulated by a local governmental entity which must continue to play a major role in regulating that type of discharge; whether the Discharger is observing reasonable practices to minimize the deleterious effects of the discharge; whether a feasible treatment method exists to control the pollutants in the discharge; and whether conditionally waiving ROWDs and/or WDRs will adequately protect beneficial uses while allowing the Regional Board to utilize more of its resources to conduct field oversight, public outreach and, where necessary, enforcement. Although local government entities do not regulate water quality impacts of agricultural operations, these operations are subject to pesticide regulation and reporting. In addition, various public and private entities provide education and field assistance to growers implementing best management practices. These entities include various Resource Conservation Districts, the Monterey Bay National Marine Sanctuary, the University of California Cooperative Extension, and the programs cited in Finding 17. The Regional Board has made supplemental environmental program funds available to farm-related activities such as a watershed coordinator and monitoring, and anticipates directing further grants toward these activities, as well as to on-farm management practice implementation. Compliance with the Conditional Waiver will include reasonable management practices to minimize water quality

impacts. Management practices that reduce the amount of waste produced or contain runoff are more feasible and more effective than treatment methods and will be strongly encouraged.

14. The adoption of the Conditional Waiver is also in the public interest because (1) it includes conditions that are intended to reduce and prevent pollution and nuisance and protect the beneficial uses of the waters of the state, (2) it contains more specific and more stringent conditions for protection of water quality compared to existing regulatory programs, (3) given the number of persons who discharge waste from irrigated lands and the magnitude of acreage involved, it provides for an efficient and effective use of limited Regional Board resources, (4) it provides flexibility for the Dischargers who seek coverage under the Conditional Waiver by providing them with the option of complying with monitoring requirements through participation in cooperative monitoring programs or individually, and (5) it builds on, rather than replaces, existing efforts within the Region.

15. The Conditional Waiver provides an alternative regulatory option to adoption of WDRs for all Dischargers. Dischargers may seek coverage under this program through a tiered waiver structure. Some operations may be immediately considered for WDRs because of a past history of violations or other problems of non-compliance; however, the vast majority of operations will be allowed time to meet requirements before being considered for WDRs. The conditions of the waiver require Dischargers to comply with applicable water quality control plans and water quality objectives.

16. It is not expected that Dischargers will achieve full compliance with all of the conditions immediately. In some areas, rising groundwater with nitrate levels exceeding the drinking water standard may influence surface water concentrations substantially, making water quality improvements difficult to achieve in the short term. In others, time will be required to find the most effective combination of practices to improve water quality. The cooperative water quality monitoring program is designed to focus attention on waterbodies where objectives are not being met and allow Dischargers time to adjust practices. Although time will be allowed, increased reporting and monitoring may be required in order to ensure that water quality is improving. Even if the Regional Board were to issue WDRs to Dischargers rather than adopting this waiver, compliance schedules under California Water Code Section 13263(c) would be appropriate in most cases.

17. The Central Coast Region has benefited from the proactive approach to protecting water quality taken by several segments of the agricultural industry. Notable examples include the Agricultural Water Quality Program of the Coalition of Central Coast County Farm Bureaus (Farm Bureau Coalition) and efforts to promote sustainable wine growing practices by the Central Coast Vineyard Team and the Central Coast Winegrowers Association. Efforts are also underway to promote sustainable practices by Spanish-speaking farmers through the Rural Development Center and the Agricultural Land-Based Training Association (ALBA) in Monterey County. A consideration in developing the new regulatory program was the impact such a program would have on existing water quality protection efforts by the agricultural industry. Continuing and building on such efforts is in the public interest. Staff has worked with the agricultural and environmental communities in the Region to find areas of agreement on the broad outline of an irrigated agriculture water quality program.

How does the Conditional Waiver give "credit" to growers who have been proactive in protecting water quality?

18. Under the Monterey Bay Sanctuary's Plan for Agriculture, the Farm Bureau Coalition is organizing growers into watershed working groups who attend Farm Water Quality Planning short courses as a group and develop farm plans. The Waiver's education and plan requirements are modeled on this, so growers who are participating in the Sanctuary effort will likely be in Tier 1 (see Part IIC, "Waiver Tiers") and have fewer reporting requirements and lower costs. Growers who have completed other qualifying water quality education classes and developed plans that meet the waiver requirements will also qualify for Tier 1. Vineyards operations that have completed Positive Point System evaluations will be able to use them as part of their farm plans. Regional Board staff also recommends that growers who meet the education and planning requirements and who have already implemented substantial management practices to protect water quality have reduced monitoring costs under the cooperative monitoring program, and be considered as a "low-threat" discharge (see below).

What is the management practice checklist?

19. The management practice checklist/self-assessment is a short questionnaire that allows the Discharger to identify management practices that are being implemented for water quality protection. The Regional Board will provide a template prior to the enrollment deadline. The template will include practices for irrigation management, nutrient management, pesticide management and erosion control. Dischargers will also be able to add practices if they are known or likely to have a water quality benefit. The template will be available on-line. Tier 1 dischargers will submit an updated checklist once during the waiver cycle (five years); Tier 2 dischargers will submit a checklist annually as part of their annual report. In areas where water quality monitoring identifies problems, checklists will be used to assess whether practices need to be adjusted or whether increased implementation is needed.

What is a "low-threat" discharge?

20. A low-threat discharge is a discharge that has very low potential to impact water quality because of management practices in place. For the purposes of this Conditional Waiver a low-threat discharge category could be defined in the cost allocation structure of the cooperative monitoring program and qualify for reduced monitoring costs.

If I have no discharge, do I have to apply for a Waiver?

21. If an operation does not discharge waste that could affect water quality, then there is no need to obtain coverage under the Conditional Waiver. "Waste" includes (among other things) any residual pesticide, herbicide, or fertilizer that is not taken up or beneficially used for its intended purpose. Any discharge of waste that could percolate to groundwater or run off in tail water or stormwater is a discharge for purposes of this waiver. Waste discharges also include sediment that runs off a field (erosion) due to land disturbance activities. It is very difficult to be certain that an operation has no discharge, particularly to groundwater or during storm events; however, Dischargers that qualify for Tier 1 have fewer reporting requirements and facilities that have implemented management practices may be considered for a low-threat discharge category in the cooperative monitoring program and could have reduced monitoring costs.

What if I lease land?

22. Under the terms of the Conditional Waiver, both owners and operators of irrigated land have responsibility for compliance with the conditions of the waiver. A farm map must be submitted along with the Notice of Intent (see Part II below). Farm water quality management plans must specify management practices for the operation identified in the map. Many management practices will be operational in nature and under the direct control of the operator, while structural practices which remain in place through changes in leaseholders will more likely be the responsibility of the landowner. In the event that the Regional Board undertakes enforcement action, it is likely that both the owner and the operator will be held accountable. Owners and operators may consider delineating these responsibilities in lease agreements; however, both the owner and operator will retain full legal responsibility for complying with all provisions of the applicable waiver.

How do I apply?

23. Dischargers seeking authorization to discharge under the Conditional Waiver shall submit a complete *Notice of Intent (NOI) to Comply with the Terms of the Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Land.* The Notice of Intent form will be available from the Regional Water Quality Control Board upon request and on the Regional Board's website.

24. Information that must be submitted as part of the NOI includes the location of the operation, identification of responsible parties (owners/operators), a map of the operation (should be the same as is submitted to the Agricultural Commission for pesticide use applications or equivalent), a management practice checklist/self-assessment on a template provided by the Regional Board, certification of completion of Regional Board-approved water quality education, a signed statement of farm water quality plan completion, if applicable, and which monitoring option is elected. Certificates of education and statement of plan completion will be used to evaluate which category of waiver is appropriate.

When do I apply?

25. The deadline for submitting a Notice of Intent is **January 1, 2005**. All task and milestone due dates are listed in Part IV (Provisions) of this Order. All Dischargers must apply for coverage under the conditional waiver by **January 1, 2005.**

Is a fee required?

26. Not at this time. Recently passed Senate Bill 923 authorizes the payment of fees for conditional waivers. A fee schedule may be set by the State Board based on a number of factors, including acreage, and monitoring and compliance costs. The Regional Board cannot charge fees until after the State Board adopts a fee schedule for waivers.

Is monitoring required?

27. California Water Code Section 13269 requires conditional waivers to include a monitoring program that verifies the adequacy and effectiveness of the waiver's conditions. Monitoring programs can be individual, group (cooperative), or watershed-based. As long as a Discharger

complies with all of the provisions and requirements of the waiver, if group monitoring adequately verifies that the waiver conditions adequately protect water quality, a cooperative monitoring approach satisfies Section 13269.

28. Monitoring requirements and options are described in Monitoring and Reporting Program (MRP) R3-2004-0117. All Dischargers will be required to elect a monitoring option. Dischargers may elect to perform individual monitoring or participate in cooperative monitoring. Cooperative monitoring in general offers a much less costly alternative to individual monitoring. A Discharger may change the monitoring option election at any time by submitted a revised NOI. The revised NOI must include a proposed monitoring and reporting plan (to elect individual monitoring) or a demonstration that the Discharger is participating in a cooperative monitoring program (for cooperative monitoring).

How will the cooperative monitoring program work?

29. The cooperative monitoring program, which was developed by Regional Board monitoring program staff, with input from the Agricultural Advisory Panel and researchers within the Region, will focus on currently applied agricultural constituents. The program calls for monitoring at sites located on the main stems and tributaries of rivers in the agricultural areas of the region. Monthly sampling will be conducted to analyze nutrients (nitrate, ammonia, orthophosphate) and some general parameters such as temperature, dissolved oxygen, total dissolved solids, pH, turbidity, and flow. Monthly monitoring of these constituents in a set of fixed locations will improve the Regional Board's ability to determine whether water quality is improving over time. It takes much longer to detect change, statistically speaking, with less frequent monitoring, and change detection is important for determining whether the waiver is effective. Monitoring of these conventional pollutants is less expensive than other program components, such as toxicity, and thus is a comparatively inexpensive way to increase the ability to detect improvements in water quality resulting from management practices. Data from the Regional Board's Central Coast Ambient Monitoring Program (CCAMP) shows that exceedances of these general water quality parameters are often associated with toxicity in waters affected by agricultural runoff. The cooperative monitoring program will make provision for follow-up monitoring with a certain fixed proportion of its budget, as another means of maintaining costs at a reasonable level.

30. Monitoring for individual pesticides can be expensive and does not assess additive or synergistic effects or impacts to beneficial uses. The cooperative monitoring program proposes instead to look first at in-stream effects, by performing toxicity testing at the same set of sites four times per year, twice during the irrigation season and twice during the storm season. The program will also characterize in-stream health by examination of insects and other invertebrates that live in the streams. In combination with toxicity sampling, this approach will enable the Regional Board to assess the overall impact of the discharges to beneficial uses, such as aquatic life and habitat.

31. Cooperative monitoring will allow growers to pool resources to meet monitoring requirements at a lower cost than individual monitoring. The monitoring sites will be located primarily in agricultural areas with previously identified water quality problems, but will also incorporate other monitoring efforts to provide coverage throughout the agricultural areas of the region. Regional Board staff is directed to work with the agricultural industry to assist the industry to establish or identify an existing nonprofit entity. This entity will be responsible for establishing a dues schedule, collecting funds and conducting the monitoring program adopted by the Regional Board. The Central Coast Ambient Monitoring Program will provide additional monitoring as part of its five-year rotation scheme, and monitoring data from other agencies will be

incorporated wherever possible. The nonprofit entity will also have the ability to receive grant funds and other sources of revenue to reduce costs to growers. The Regional Board strongly encourages the industry to seek available grant funds to reduce monitoring costs for participating Dischargers, either through a cooperative monitoring entity or through other eligible entities.

What will cooperative monitoring cost?

32. The total annual cost of the cooperative monitoring program is estimated to be between $900,000 and $1.0 million. The contribution of each discharger participating in the cooperative monitoring program will be based on a cost schedule developed by the agricultural industry and the nonprofit entity, as described in paragraph 31. Regional Board staff will work with the cooperative monitoring program to develop a reasonable cost to individuals based on a number of factors, including type of discharge and threat to water quality. Settlement funds and grant funds may be used to supplement resources and reduce overall costs.

33. The Regional Board encourages the cooperative monitoring program to develop reduced monitoring charges for low-threat discharges.

What are some considerations in establishing a monitoring program?

34. The monitoring program must verify the adequacy and effectiveness of the waiver's conditions. In establishing a monitoring program, the Regional Board may consider the volume, duration, frequency, and constituents of the discharge, and the extent and type of existing monitoring activities. The monitoring program can rely on other agencies' or organizations' water quality monitoring programs in lieu of establishing a separate monitoring program as long as those programs provide sufficient data of adequate quality; if other program data are of adequate quality but incomplete, the Board can still rely on the other data and limit the additional monitoring requirements to what is needed to fill data gaps.

35. There are a number of surface water quality monitoring programs in the Central Coast Region. However, few on-going programs assess impacts to beneficial uses from agricultural chemicals through chemical testing, toxicity testing or benthic invertebrate monitoring. The Regional Board's Central Coast Ambient Monitoring Program conducts relatively detailed monitoring on a five-year rotational cycle. Data from this program and others can be used to supplement the monitoring program, but will not provide sufficient data to verify the adequacy and effectiveness of the waiver, nor to detect improvements in water quality due to changes in management practices within the time frame of the waiver.

    The Regional Board recognizes that a certain amount of time will be required to put a cooperative monitoring program in place, but an unreasonable delay in monitoring will violate CWC Section 13269, which requires monitoring to verify the adequacy of the waiver's conditions. Staff will assist the agricultural industry to identify a suitable entity to manage the cooperative monitoring program. The entity must demonstrate to the Executive Officer's satisfaction that it is technically able to carry out the monitoring and reporting program (either directly or by hiring a consultant or other acceptable organization to perform monitoring and reporting) and that it has or will have adequate financial resources to do so. Demonstration of financial capability should include development of a budget which may incorporate funding from outside sources, such as grants. A dues schedule should be developed in consideration of input from the agricultural industry. The entity, working with Regional Board staff, shall advise Dischargers on the availability of the cooperative monitoring program. Each Discharger covered by the waiver is ultimately responsible for compliance and must perform individual monitoring if the cooperative monitoring is not established. The entity will notify the Regional Board of any enrolled dischargers who cease to comply with dues schedules or other enrollment requirements; such dischargers will be considered out of compliance with the conditions of the waiver unless they begin individual monitoring immediately. Staff will provide to the agricultural industry's "monitoring subcommittee," data as part of an inventory and review of existing data and monitoring efforts. The "monitoring subcommittee" may develop an alternative monitoring protocol for consideration by the Regional Board. The Board shall hold a public hearing and consider the agricultural industry's "monitoring subcommittee's" alternative monitoring protocol. Monitoring and Reporting Program R3-2004-0117 will be implemented as proposed, beginning in the lower Salinas/Elkhorn and Santa Maria areas, and shall be implemented by January 1, 2005. Full regionwide monitoring, in accordance with MRP R3-2004-0117 or an alternative monitoring protocol approved by the Regional Board at a public hearing, shall be implemented by January 1, 2006.

36. All requirements for technical and monitoring reports are pursuant to California Water Code section 13267. These reports are necessary to evaluate each Discharger's compliance with the terms and conditions of the Conditional Waiver, to verify the adequacy and effectiveness of the waiver's conditions and to evaluate whether additional regulatory programs or enforcement actions are warranted. Failure to submit reports in accordance with schedules established by this Order, Monitoring and Reporting Program R3-2004-0117, or an individual or cooperative monitoring plan, or failure to submit a report of sufficient technical quality to be acceptable to the Executive Officer, may subject the Discharger to enforcement action pursuant to Section 13268 of the California Water Code.

Why is agriculture being required to do more monitoring than other land uses?

37. California Water Code Section 13267 requires the cost of monitoring to be reasonable in light of the information to be obtained. Identified water quality problems in agricultural areas, in conjunction with the large number of Clean Water Act 303(d) listings that identify agriculture as a potential source justify greater monitoring than is necessary for other land uses, such as urban stormwater, which is not known to be causing as high a level of regional impact. However, when water quality monitoring indicates sources other than agriculture may be contributing to a problem, the other sources will be required to provide monitoring and other information to the Regional Board.

Is groundwater monitoring required?

38. No. Existing groundwater monitoring efforts around the region will be used in lieu of any agricultural groundwater monitoring requirements.

What if groundwater already violates standards?

39. Groundwater in many agricultural areas of the region shows nitrate levels exceeding drinking water standards. Growers will not be held liable for historical conditions. Since high nitrate groundwater in agricultural areas is often used for irrigation, farm plans need to include nutrient management practices to ensure that current discharges to groundwater do not further degrade groundwater. Plans also should account for specific nitrate concentrations in irrigation water in determining agronomic nitrogen application rates.

Am I expected to contain all stormwater on my property?

40. Although there is no requirement to contain all stormwater on site, all farm plans must identify practices to reduce discharges during storm events. Operations should choose the best combination of practices to reduce and/or detain runoff, reduce erosion and reduce the discharge of sediment, nutrients and pesticides during storms. Conservation practices that could pose a threat to public safety, for example, sediment detention basins that include earthen embankments, should conform to relevant local ordinances and engineering standards. Other management practices such as cover crops, filter strips, or furrow alignment, should aim to reduce runoff quantity and velocity, hold fine particles (silt and clay) in place, and increase infiltration to minimize impacts to stormwater quality. The goal of these combined practices should be to minimize stormwater runoff for the first half inch of rain during each storm, and to reduce runoff for the first one and one-half inches of rain during each storm. There is no requirement to contain or manage waste in stormwater runoff that enters the farm from off site, but the occurrence of such runoff does not change the goal of managing waste generated on site.

What happens if a Tier 2 discharger fails to meet requirements for Tier 1 within the three year time limit?

41. Dischargers who fail to meet Tier 1 requirements within three years will be issued Waste Discharge Requirements if they have made no progress toward meeting Tier 1 requirements. Progress includes completion of five hours of water quality training each year and progress toward completion of a farm water quality plan. Prior to issuance of Waste Discharge Requirements, the Discharger may ask the Regional Board to consider extenuating circumstances, such as lack of available training and financial hardship.

Regulatory Considerations

42. Basin Plan – The Regional Board adopted the Water Quality Control Plan, Central Coast Basin (Basin Plan) on September 8, 1994. The Basin Plan incorporates State Board plans and policies by reference and contains a strategy for protecting beneficial uses of surface and ground waters throughout the Region. This conditional waiver requires Dischargers to comply with all applicable provisions of the Basin Plan.

43. Beneficial Uses – Existing and potential beneficial uses of surface and groundwaters within the Central Coast Region include municipal and domestic supply; agricultural supply; industrial process and service supply; recreation; warm and cold freshwater habitat; wildlife habitat; migration; spawning; areas of special biological significance (now called State Water Quality Protection Areas or SWQPAs); rare, threatened or endangered species; freshwater replenishment; and groundwater recharge. Beneficial uses that apply to all waterbodies, unless otherwise identified in the Basin Plan, include municipal and domestic supply, recreation, and aquatic life (either warm or cold freshwater habitat, as applicable).

44. California Environmental Quality Act – For purposes of adoption of this Waiver Order, the Regional Board is the lead agency pursuant to the California Environmental Quality Act (CEQA) (Public Resources Code Sections 21100 et. seq.). The action to adopt a conditional waiver is intended to protect and improve water quality. The waiver order sets forth conditions that will require Dischargers to implement management practices to protect water quality and to monitor to ensure that such practices are effective and are improving water quality. The Regional Board

has not regulated the discharges subject to this waiver Order to this extent in the past. Such regulation will result in protection, maintenance and improvement of water quality. The Regional Board adopted a Negative Declaration in Resolution R3-2004-0118.

45. Anti-Degradation – This Order is consistent with the Provisions of State Water Resources Control Board Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality of Waters in California." Regional boards, in regulating the discharge of waste, must maintain high quality waters of the State until it is demonstrated that any change in quality will be consistent with maximum benefit to the people of the State, will not unreasonably affect beneficial uses, and will not result in water quality less than that described in a regional board's policies. This conditional waiver Order will result in improved water quality throughout the region. Dischargers must comply with all applicable provisions of the Basin Plan, including water quality objectives, and implement best management practices to prevent pollution or nuisance and to maintain the highest water quality consistent with the maximum benefit to the people of the State. The conditions of this waiver will protect high quality waters and restore waters that have already experienced some degradation.

46. The goal of this Order and Conditional Waiver is to improve and protect water quality by providing a program to manage discharges from irrigated lands that cause or contribute to conditions of pollution or nuisance as defined in Section 13050 of the California Water Code or that cause or contribute to exceedances of any Regional or State Board numeric or narrative water quality standard by reducing discharges of waste.

47. Interested parties were notified of the intent to adopt a conditional waiver of waste discharge requirements for discharges from irrigated lands, including irrigation wastewater and/or stormwater, to surface waters and groundwater as described in this Waiver Order and were provided an opportunity for a public hearing and an opportunity to submit written comments.

48. In a public hearing, all comments pertaining to this Waiver Order were heard and considered.

IT IS HEREBY ORDERED that, pursuant to California Water Code sections 13263, 13267 and 13269, Dischargers of irrigation wastewater and/or stormwater from irrigated lands to waters of the state, who file for coverage under this Waiver Order in order to meet the provisions contained in California Water Code Division 7 and regulations and plans and policies adopted thereunder, and who request waiver of waste discharge requirements, shall comply with the following terms and conditions:

PART I. WAIVER

1. The discharge of any wastes not specifically regulated by the waiver described herein is prohibited unless the Discharger complies with CWC Section 13260(a) and the Regional Board either issues waste discharge requirements pursuant to CWC Section 13263 or an individual waiver pursuant to CWC Section 13269 or the time frames specified in CWC Section 13264(a) have elapsed.

2. The Regional Board waives the submittal of a ROWD and WDRs for discharges from irrigated land if the Discharger complies with the conditional waiver described in this Order and Monitoring and Reporting Program R3-2004-0117.

3. Dischargers shall take action to comply with the terms and conditions of the waiver adopted by this Order and improve and protect waters of the state.

4. This waiver shall not create a vested right and all such discharges shall be considered a privilege, as provided for in CWC Section 13263.

5. Pursuant to CWC Section 13269, this action waiving the issuance of waste discharge requirements for certain specific types of discharges: (a) is conditional, (b) may be terminated at any time, (c) does not permit an illegal activity, (d) does not preclude the need for permits which may be required by other local or governmental agencies, and (e) does not preclude the Regional Board from taking enforcement actions (including civil liability) pursuant to the CWC.

PART II. WAIVER PROGRAM

A. Definitions

1. Irrigated lands – lands where water is applied for the purpose of producing commercial crops. For the purpose of this Conditional Waiver, irrigated lands include, but are not limited to, land planted to row, vineyard, field and tree crops, commercial nurseries, nursery stock production, and greenhouse operations with soil floors.

2. Irrigation return flow – surface and subsurface water which leaves the field following application of irrigation water.

3. Tailwater – the runoff of irrigation water from the lower end of an irrigated field.

4. Stormwater runoff – the runoff of precipitation from the lower end of an irrigated field.

5. Subsurface drainage – water generated by installing drainage systems to lower the water table below irrigated lands. The drainage can be generated by subsurface drainage systems, deep open drainage ditches or drainage wells.

6. Discharge - a release of a waste to waters of the State, either directly to surface waters or through percolation to groundwater. Wastes from irrigated agriculture include earthen materials (soil, silt, sand, clay, rock), inorganic materials (metals, salts, boron, selenium, potassium, nitrogen, phosphorus, etc.), and organic materials such as pesticides.

7. Discharger - the owner and/or operator of irrigated cropland on or from which there are discharges of waste that could affect the quality of any surface water or groundwater.

8. Requirement of applicable water quality control plans- a water quality objective, prohibition, Total Maximum Daily Load (TMDL) implementation plan, or other requirement contained in water quality control plans adopted by the Regional Board and approved according to applicable law.

9. Monitoring - refers to all types of monitoring undertaken in connection with determining water quality conditions and factors that may affect water quality conditions, including but not limited to, in-stream water quality monitoring undertaken in connection with agricultural

activities, monitoring to identify short and long-term trends in water quality, inspections of operations, management practice implementation and effectiveness monitoring, maintenance of on-site records and management practice reporting.

10. Farm Water Quality Management Plan (Farm Plan) - a document that contains, at a minimum, identification of practices that are currently being or will be implemented to address irrigation management, pesticide management, nutrient management and erosion control to protect water quality. Plans will contain a schedule for implementation of practices. Lists of water quality protection practices are available from several sources, including the University of California farm plan template available from the University of California and on-line at http://anrcatalogue.ucdavis.edu/merchant.ihtml?pid=5604&step=4.

11. All other terms shall have the same definitions as prescribed by California Water Code Division 7, unless specified otherwise.

B. Enrollment Process

All applicants must submit the following information as part of their Notice of Intent (NOI) to enroll:

- Completed application form, including location of the operation and identification of responsible parties (owners/operators)
- Copy of map of operation (map should be the same as the one submitted to the County Agricultural Commissioner for Pesticide Use Reporting, or equivalent)
- Completed management practice checklist/self assessment form
- Certificates of attendance at Regional Board-approved farm water quality education courses, if applicable
- Statement of farm water quality plan completion, if applicable
- Election for cooperative or individual monitoring

C. Waiver Tiers

Tier 1 Qualifications and Reporting Requirements

Tier 1 conditional waivers will be five years in length. To qualify for a Tier 1 conditional waiver, Dischargers must do the following:

a. complete 15 hours of Regional Board-approved farm water quality education by the enrollment deadline
b. complete a Farm Plan by the enrollment deadline
c. provide a biennial practice implementation checklist to the Regional Board demonstrating that the Discharger is implementing the Farm Plan, or that the Discharger has made and is implementing appropriate changes to the Farm Plan
d. perform individual water quality monitoring or participate in cooperative water quality monitoring

Tier 2 Qualifications and Reporting Requirements

Tier 2 conditional waivers will be one year in length, renewable up to three years. To qualify for a Tier 2 conditional waiver, operations must do the following:

a. complete at least 5 hours of Regional Board-approved water quality education per year, up to a total of at least 15 hours (the first 5 hours may be completed after enrollment)
b. complete a Farm Plan within three years of the enrollment deadline

c. provide annual practice implementation checklists identifying currently implemented and planned management practices and progress reports on completion of requirements to the Regional Board
d. perform individual water quality monitoring or participate in cooperative water quality monitoring

D. General Conditions for <u>All</u> Waiver Holders

1. The Discharger shall not cause or contribute to conditions of pollution or nuisance as defined in CWC Section 13050.

2. The Discharger must comply with all requirements of applicable water quality control plans.

3. The Discharger shall not cause or contribute to exceedances of any Regional, State, or Federal numeric or narrative water quality standard.

4. Wastewaters percolated into groundwater shall be of such quality at the point where they enter the ground so as to assure the protection of all actual or designated beneficial uses of all groundwaters of the basin.

5. Wastes discharged to groundwater shall be free of toxic substances in excess of maximum contaminant levels (MCLs) for primary and secondary drinking water standards established by the United States Environmental Protection Agency or California Department of Health Services, whichever is more stringent; taste, odor, or color producing substances; and nitrogenous compounds in quantities which could result in a groundwater nitrate concentration (as NO_3) above 45 mg/l.

6. The Discharger shall comply with each applicable Total Maximum Daily Load (TMDL), including any plan of implementation for the TMDL, commencing with the effective date or other date for compliance stated in the TMDL. If an applicable TMDL does not contain an effective date or compliance date, the Discharger shall commence compliance with the TMDL's implementation plan no later than twelve months after USEPA approves the TMDL.

7. The Discharger shall comply with applicable time schedules.

8. This Conditional Waiver does not authorize the discharge of any waste not specifically regulated under this Order. Waste specifically regulated under this Order includes: earthen materials, including soil, silt, sand, clay, rock; inorganic materials including metals, salts, boron, selenium, potassium, nitrogen, phosphorus, etc.; and organic materials such as pesticides that enter or threaten to enter into waters of the state. Examples of waste not specifically regulated under this Order include hazardous materials, and human wastes.

9. Objectionable odors due to the storage of wastewater and/or stormwater shall not be perceivable beyond the limits of the property owned or operated by the Discharger.

PART III. RECOMMENDATIONS

1. Controlling pollutants at the source should be the primary approach to water quality protection.

2. Irrigation efficiency improvement should be used to minimize wastewater generation.

3. Crop nutrient requirements should be evaluated to minimize fertilizer applications.

4. Irrigation water nitrate and soil nitrate content should be incorporated in fertilization decisions.

5. Erosion control should be considered as part of storm water management and irrigation water management.

6. Integrated pest management techniques, such as pest population monitoring, should be incorporated into pest control decision-making to minimize use of pesticides.

PART IV. PROVISIONS

1. The Discharger shall comply with an individual or cooperative Monitoring and Reporting Program approved by the Regional Board Executive Officer.

2. A copy of the Conditional Waiver and farm water quality plan shall be kept at the operation for reference by operating personnel. Key operating and site management personnel shall be familiar with its contents.

3. In the event of any change in control or ownership of an operation presently owned or controlled by the Discharger, the Discharger shall notify the succeeding owner or operator of the existence of this conditional waiver order by letter, a copy of which shall be immediately forwarded to the Regional Board Executive Officer. The new Discharger shall submit a NOI within 30 days.

4. The Discharger shall take all reasonable steps to prevent any discharge in violation of this conditional waiver.

5. The Discharger shall furnish the Regional Board, within a reasonable time, any information that the Board may request to determine compliance with this conditional waiver Order.

6. The Discharger shall allow Regional Board staff reasonable access onto the subject property (the source of runoff and percolating water) whenever requested by Regional Board staff for the purpose of performing inspections and conducting monitoring, including sample collection, measuring, and photographing to determine compliance with conditions of the waiver.

7. Pursuant to CWC section 13267, the following information/reports shall be submitted to the Regional Board according to the following time schedule to ensure compliance with the terms and conditions of this Conditional Waiver, unless the Regional Board has granted a time extension[1]:

[1] The Regional Board recognizes that the cooperative monitoring entity is not a discharger subject to regulation under the Porter-Cologne Water Quality Control Act. However, the cooperative monitoring entity must satisfy the milestones applicable to it before any individual discharger may rely on cooperative monitoring to satisfy the discharger's monitoring requirements.

Reporting Tasks/Milestones	Responsible Party	Due Date
Notice of Intent	All Dischargers	January 1, 2005
Annual Report	Tier 2 Dischargers	January 1, 2006 and annually thereafter
Management Practice Checklist Update	Tier 1 Dischargers	January 1, 2007

Monitoring Tasks/Milestones	Responsible Party	Due Date
Establish an Agricultural Committee*	Cooperative Monitoring Program	September 1, 2004
Establish a Cost Allocation Subcommittee*	Cooperative Monitoring Program	November 1, 2004
Establish a Agricultural Monitoring Subcommittee* (not required)	Cooperative Monitoring Program	As early as possible
Establish a Cooperative Monitoring Entity*	Cooperative Monitoring Program	January 1, 2005
Approved Quality Assurance Project Plan and Sampling Plan	Cooperative Monitoring Program/Individual Dischargers	January 1, 2005
Start Date Salinas and Santa Maria Area Monitoring	Cooperative Monitoring Program	January 1, 2005
Start Date for Individual Monitoring	Individual Dischargers	October 1, 2005
Submit List of Participants in Cooperative Monitoring Program	Cooperative Monitoring Program	January 1, 2006
Submit Cost Allocation Formula	Cooperative Monitoring Program	January 1, 2006
Start Date for Regionwide Cooperative Monitoring	Cooperative Monitoring Program	January 1, 2006
Electronic Monitoring Data Submittal	Cooperative Monitoring Program/Individual Dischargers	Three months after start of monitoring and quarterly thereafter
Hard Copy Monitoring Report Submittal	Cooperative Monitoring Program/Individual Dischargers	January, 2007 and annually thereafter

* The Agricultural Committee will have the sole authority to determine the membership of the Agricultural Monitoring Committee and Cost Allocation Committee. The Agricultural Committee is not required to open committee membership to the general public

8. All reports, NOI, or other documents required by this conditional waiver Order, and other information requested by the Regional Board shall be signed by the owner and/or operator of an irrigated operation.

9. Any person signing a NOI, monitoring report, or technical report makes the following certification, whether written or implied:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

10. Violations of this conditional waiver may result in enforcement actions as authorized under the CWC.

11. Conditional waivers may be issued for five years and may only be reissued after a public hearing. The conditional waiver will be reviewed at a public hearing on or before May 13, 2009. At that time, additional conditions may be imposed.

12. A waiver of WDRs for a type of discharge may be superseded by the adoption by the State Board or Regional Board of specific waste discharge requirements or general waste discharge requirements for specific discharges.

13. The Regional Board may review this Order and Conditional Waiver at any time and may modify or terminate the waiver in its entirety or for individual Dischargers as appropriate.

14. The Regional Board directs the Executive Officer to provide regular updates to the Regional Board regarding the effectiveness of the conditional waiver to regulate these types of discharges. These updates may include: Executive Officer Reports, memoranda, staff reports, workshops, and agenda items.

15. This Order and Conditional Waiver shall become effective **July 9, 2004** and expire **July 9, 2009** unless rescinded, renewed or extended by the Regional Board.

I, Roger W. Briggs, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, Central Coast Region, on July 9, 2004.

Bradley E. Hagman

FOR Roger W. Briggs
Executive Officer

Exhibit 3

Addressing Nitrate in California's Drinking Water

With a Focus on Tulare Lake Basin and Salinas Valley Groundwater

Report for the State Water Resources Control Board Report to the Legislature

California Nitrate Project,
Implementation of Senate Bill X2 1

Center for Watershed Sciences
University of California, Davis
http://groundwaternitrate.ucdavis.edu

Prepared for the California State Water Resources Control Board

The health of our waters
is the principal measure
of how we live on the land.

—Luna Leopold

Addressing Nitrate in California's Drinking Water

With a Focus on Tulare Lake Basin and Salinas Valley Groundwater

Report for the State Water Resources Control Board Report to the Legislature

This Report and its associated eight Technical Reports were prepared by

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Center for Watershed Sciences • University of California, Davis

Groundwater Nitrate Project, Implementation of Senate Bill X2 1

Prepared for California State Water Resources Control Board • January 2012

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Contents

Tables

Figures

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Acronyms and Abbreviations

AB	Assembly Bill
ac	Acre (about 0.4 hectares)
AF	Acre-foot (about 1,233 cubic meters)
AMBAG	Association of Monterey Bay Area Governments
AQUA	Association of People United for Water
ARRA	American Recovery and Reinvestment Act
AWP	Agricultural Waiver Program
BD	Biological Denitrification
BMP	Best Management Practices
CAA	Cleanup and Abatement Account
CalEPA	California Environmental Protection Agency
CAL FAC	California Food and Agriculture Code
CalNRA	California Natural Resources Agency
CCR	California Code of Regulations
CCR	Consumer Confidence Report
CDBG	Community Development Block Grant
CDFA	California Department of Food and Agriculture
CDPH	California Department of Public Health
CoBank	Cooperative Bank
CPWS	Community Public Water System
CRWA	California Rural Water Association
CV-SALTS	Central Valley Salinity Alternative for Long-Term Sustainability
CVSC	Central Valley Salinity Coalition
CWA	Clean Water Act
CWC	Community Water Center
CWSRF	Clean Water State Revolving Fund
DAC	Disadvantaged Communities
DPEIR	Draft Program Environmental Impact Report (of the Central Valley ILRP)
DPR	California Department of Pesticide Regulation
DWR	California Department of Water Resources
DWSAP	Drinking Water Source Assessment and Protection
DWSRF	Drinking Water State Revolving Fund
EDA	U.S. Economic Development Administration

EDR	Electrodialysis Reversal
ERG	Expense Reimbursement Grant Program
ERP-ETT	Enforcement Response Policy and Enforcement Targeting Tool
FFLDERS	Feed, Fertilizer, Livestock, Drugs, and Egg Regulatory Services
FMIP	Fertilizing Materials Inspection Program
FP	Food Processors
FREP	Fertilizer Research and Education Program
GAMA	Groundwater Ambient Monitoring and Assessment
Gg	Gigagram (1 million kilograms, about 1,100 tons)
ha	Hectare (about 2.5 acres)
HAC	Housing Assistance Council
HSNC	Historical Significant Non-Compliers
HUD	U.S. Department of Housing and Urban Development
I-Bank	California Infrastructure and Economic Development Bank
ILRP	Irrigated Lands Regulatory Program
IRWM	Integrated Regional Water Management
ISRF	Infrastructure State Revolving Fund
IX	Ion Exchange
KCWA	Kern County Water Agency
kg	Kilogram (about 2.2 pounds)
L	Liter (about 1.06 liquid quarts)
lb	Pound (about 0.45 kilogram)
LLNL	Lawrence Livermore National Lab
MCL	Maximum Contaminant Level
MCWRA	Monterey County Water Resources Agency
mg	Milligram (about 0.00003 ounce)
MHI	Median Household Income
MUN	Municipal or domestic water supply (beneficial use)
NDWC	National Drinking Water Clearinghouse
NMP	Nutrient Management Plan
NPDES	National Pollutant Discharge Elimination System
NRWA	National Rural Water Association
NUE	Nitrogen Use Efficiency
NWG	Nitrate Working Group

O&M	Operations and Maintenance
OW	EPA's Office of Water
PES	Payment for Ecosystem Services
PHG	Public Health Goal
PNB	Partial Nutrient Balance
POE	Point-of-Entry (for household water treatment)
Porter-Cologne	Porter-Cologne Water Quality Control Act (California Water Code § 13000 et seq.)
POU	Point-of-Use (for household water treatment)
PPL	Project Priority List
PWS	Public Water System
RCAC	Rural Community Assistance Corporation
RCAP	Rural Community Assistance and Partnership
RO	Reverse Osmosis
RUS	Rural Utilities Service
SB	Senate Bill
SDAC	Severely Disadvantaged Communities
SDWA	Safe Drinking Water Act
SDWSRF	Safe Drinking Water State Revolving Fund
SEP	Supplement Environmental Program
SHE	Self-Help Enterprises
SRF	State Revolving Fund
SSWS	State Small Water System
SV	Salinas Valley
t	Ton (U.S. short ton, about 907 kilograms)
TLB	Tulare Lake Basin
U.S. EPA	United States Environmental Protection Agency
U.S.C.	United States Code
USDA	United States Department of Agriculture
USGS	U.S. Geological Survey
WARMF	Watershed Analysis Risk Management Framework
WDR	Waste Discharge Requirements
WEP	Water Environmental Program
WMP	Waste Management Plan
WWTP	Wastewater Treatment Plant

Executive Summary

Executive Summary

In 2008, Senate Bill SBX2 1 (Perata) was signed into law (Water Code Section 83002.5), requiring the State Water Resources Control Board (State Water Board), in consultation with other agencies, to prepare a Report to the Legislature to "improve understanding of the causes of [nitrate] groundwater contamination, identify potential remediation solutions and funding sources to recover costs expended by the State… to clean up or treat groundwater, and ensure the provision of safe drinking water to all communities." The University of California prepared this Report under contract with the State Water Board as it prepares its Report to the Legislature.

This executive summary focuses on major findings and promising actions. Details can be found in the Main Report and eight accompanying Technical Reports.

Key Issues

Groundwater is essential to California, and nitrate is one of the state's most widespread groundwater contaminants. Nitrate in groundwater is principally a by-product of nitrogen use, a key input to agricultural production. However, too much intake of nitrate through drinking water can harm human health.

California's governments, communities, and agricultural industry have struggled over nitrate contamination for decades. **The California Department of Public Health (CDPH) has set the maximum contaminant level (MCL)** for nitrate in drinking water at 45 milligrams per liter (as nitrate). Nitrate concentrations in public drinking water supplies exceeding the MCL require water system actions to provide safe drinking water.

For this study, the four-county **Tulare Lake Basin and the Monterey County portion of the Salinas Valley are examined**. About 2.6 million people in these regions rely on groundwater for drinking water. The study area includes four of the nation's five counties with the largest agricultural production. It represents about 40% of California's irrigated cropland (including 80 different crops) and over half of California's dairy herd. Many communities in the area are among the poorest in California and have limited economic means or technical capacity to maintain safe drinking water given threats from nitrate and other contaminants.

Summary of Key Findings

1. **Nitrate problems will likely worsen for several decades. For more than half a century, nitrate from fertilizer and animal waste have infiltrated into Tulare Lake Basin and Salinas Valley aquifers. Most nitrate in drinking water wells today was applied to the surface decades ago.**

2. **Agricultural fertilizers and animal wastes applied to cropland are by far the largest regional sources of nitrate in groundwater. Other sources can be locally relevant.**

3. **Nitrate loading reductions are possible, some at modest cost. Large reductions of nitrate loads to groundwater can have substantial economic cost.**

4. **Direct remediation to remove nitrate from large groundwater basins is extremely costly and not technically feasible. Instead, "pump-and-fertilize" and improved groundwater recharge management are less costly long-term alternatives.**

5. **Drinking water supply actions such as blending, treatment, and alternative water supplies are most cost-effective. Blending will become less available in many cases as nitrate pollution continues to spread.**

6. **Many small communities cannot afford safe drinking water treatment and supply actions. High fixed costs affect small systems disproportionately.**

7. **The most promising revenue source is a fee on nitrogen fertilizer use in these basins. A nitrogen fertilizer use fee could compensate affected small communities for mitigation expenses and effects of nitrate pollution.**

8. **Inconsistency and inaccessibility of data prevent effective and continuous assessment. A statewide effort is needed to integrate diverse water-related data collection activities by many state and local agencies.**

Nitrate in groundwater poses two major problems and risks:

- **Public health concerns** for those exposed to nitrate contamination in drinking water; in California's Tulare Lake Basin and Salinas Valley, roughly 254,000 people are currently at risk for nitrate contamination of their drinking water. Of these, 220,000 are connected to community public (>14 connections) or state small water systems (5–14 connections), and 34,000 are served by private domestic wells or other systems smaller than the threshold for state or county regulation and which are largely unmonitored.
- **Financial costs of nitrate contamination** include additional drinking water treatment, new wells, monitoring, or other safe drinking water actions; over 1.3 million people are financially susceptible because nitrate in raw source water exceeds the MCL, requiring actions by drinking water systems. Nitrate contamination of drinking water sources will continue to increase as nitrogen from fertilizer, manure, and other sources applied in the last half century continues to percolate downward and flow toward drinking water wells.

Findings: Sources of Nitrate Pollution

Within the study area, human-generated nitrate sources to groundwater include (Figure ES-1):

- cropland (96% of total), where nitrogen applied to crops, but not removed by harvest, air emission, or runoff, is leached from the root zone to groundwater. Nitrogen intentionally or incidentally applied to cropland includes synthetic fertilizer (54%), animal manure (33%), irrigation source water (8%), atmospheric deposition (3%), and wastewater treatment and food processing facility effluent and associated solids (2%) (Figure ES-2);
- percolation of wastewater treatment plant (WWTP) and food processing (FP) wastes (1.5% of total);
- leachate from septic system drainfields (1% of total);
- urban parks, lawns, golf courses, and leaky sewer systems (less than 1% of total); and
- recharge from animal corrals and manure storage lagoons (less than 1% of total);
- downward migration of nitrate-contaminated water via wells (less than 1% of total).

Findings: Reducing Nitrate Pollution

Options for reducing nitrate pollution were identified for all sources. For cropland, where less than 40% of applied nitrogen is removed by crop harvest, 10 management measures (and 50 practices and technologies to achieve these management objectives) were reviewed that can reduce—but not eliminate—nitrate leaching to groundwater. These fall into four categories:

1. Design and operate irrigation and drainage systems to reduce deep percolation.
2. Manage crop plants to capture more nitrogen and decrease deep percolation.
3. Manage nitrogen fertilizer and manure to increase crop nitrogen use efficiency.
4. Improve storage and handling of fertilizers and manure to decrease off-target discharge.

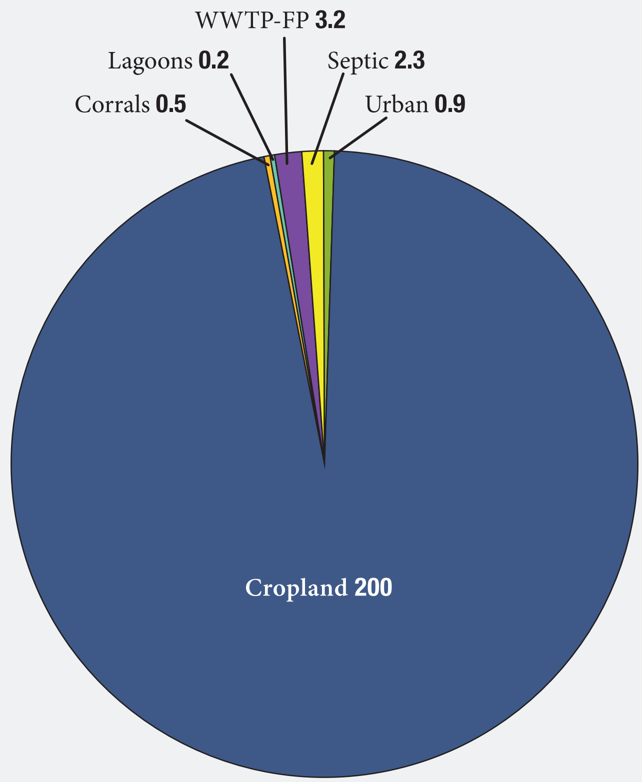
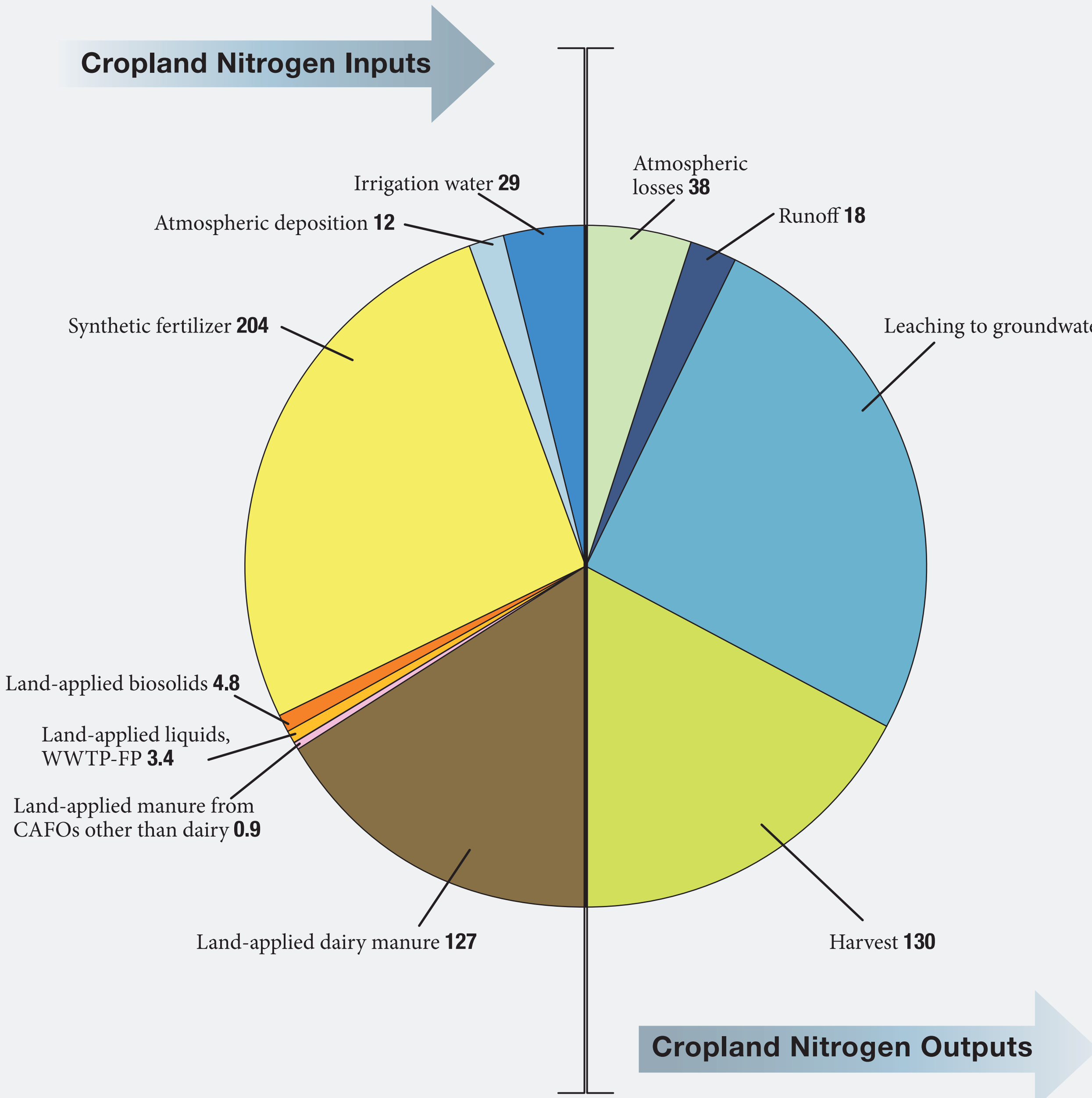


Figure ES-1. Estimated groundwater nitrate loading from major sources within the Tulare Lake Basin and Salinas Valley, in Gg nitrogen per year (1 Gg = 1,100 t).



Note: No mass balance was performed on 0.17 million ha (0.4 million ac) of nitrogen-fixing alfalfa, which is estimated to contribute an additional 5 Gg N/yr to groundwater. Groundwater nitrate loading from all non-cropland sources is about 8 Gg N/yr.

Figure ES-2. Overview of cropland input and output (Gg N/yr) in the study area (Tulare Lake Basin and Salinas Valley) in 2005. The left half of the pie chart represents total nitrogen inputs to 1.27 million ha (3.12 million ac) of cropland, not including alfalfa. The right half of the pie chart represents total nitrogen outputs with leaching to groundwater estimated by difference between the known inputs and the known outputs. Source: Viers et al. 2012.

Some of the needed improvements in nitrogen use efficiency by crops will require increased operating costs, capital improvements, and education. For some cropland, the high economic costs of nitrate source reduction sufficient to prevent groundwater degradation will likely hinder strict compliance with the state's current anti-degradation policy for groundwater (State Water Board Resolution 68-16).

Findings: Groundwater Nitrate Pollution

Groundwater nitrate data were assembled from nearly two dozen agencies and other sources (100,000 samples from nearly 20,000 wells). Of the 20,000 wells, 2,500 are frequently sampled public water supply wells (over 60,000 samples). In these public supply wells, about 1 in 10 raw water samples exceed the nitrate MCL. Apart from the recently established Central Valley dairy regulatory program in the Tulare Lake Basin, there are no existing regular well sampling programs for domestic and other private wells.

The largest percentages of groundwater nitrate MCL exceedances are in the eastern Tulare Lake Basin and in the northern, eastern, and central Salinas Valley, where about one-third of tested domestic and irrigation wells exceed the MCL. These same areas have seen a significant increase in nitrate concentrations over the past half century, although local conditions and short-term trends vary widely.

Travel times of nitrate from source to wells range from a few years to decades in domestic wells, and from years to many decades and even centuries in deeper production wells. This means that nitrate source reduction actions made today may not affect sources of drinking water for years to many decades.

Findings: Groundwater Remediation

Groundwater remediation is the cleanup of contaminated groundwater to within regulatory limits. Traditional pump-and-treat and in-place approaches to remediation, common for localized industrial contamination plumes, would cost billions of dollars over many decades to remove nitrate from groundwater in the Tulare Lake Basin and Salinas Valley. Timely cleanup of basin-scale nitrate contamination is not technically feasible.

Instead, long-term remediation by "pump-and-fertilize" would use existing agricultural wells to gradually remove nitrate-contaminated groundwater and treat the water by ensuring nitrate uptake by crops through appropriate nutrient and irrigation water management. Improved groundwater recharge management would provide clean groundwater recharge to mix with irrigation water recharge and partially mitigate nitrate levels in groundwater regionally.

Removal or reduction of contamination sources must accompany any successful remediation effort. Combining "pump-and-fertilize" with improved groundwater recharge management is more technically feasible and cost-effective.

Findings: Safe Drinking Water Supply

Nitrate contamination is widespread and increasing. Groundwater data show that 57% of the current population in the study area use a community public water system with recorded raw (untreated) nitrate concentrations that have exceeded the MCL at least once between 2006 and 2010. Continued basin-wide trends in nitrate groundwater concentration may raise the affected population to nearly 80% by 2050. Most of this population is protected by water system treatment, or alternative wells, at additional cost. But about 10% of the current population is at risk of nitrate contamination in their delivered drinking water, primarily in small systems and self-supplied households.

No single solution will fit every community affected by nitrate in groundwater. Each affected water system requires individual engineering and financial analyses.

Communities served by small systems vulnerable to nitrate contamination can (a) consolidate with a larger system that can provide safe drinking water to more customers; (b) consolidate with nearby small systems into a new single larger system that has a larger ratepayer base and economies of scale; (c) treat the contaminated water source; (d) switch to surface water; (e) use interim bottled water or point-of-use treatment until an approved long-term solution can be implemented; (f) drill a new well; or (g) blend contaminated wells with cleaner sources, at least temporarily.

There is significant engineering and economic potential for consolidating some systems. Consolidation can often permanently address nitrate problems, as well as many other problems faced by small water systems.

Solutions for self-supplied households (domestic well) or local small water systems (2–4 connections) affected by nitrate contamination are point-of-use (POU) or point-of-entry (POE) treatment and drilling a new or deeper well, albeit with no guarantee for safe drinking water.

Additional costs for safe drinking water solutions to nitrate contamination in the Tulare Lake Basin and Salinas Valley are roughly \$20 and \$36 million per year for the short- and long-term solutions, respectively. About \$17 to \$34 million per year will be needed to provide safe drinking water for 85 identified community public and state small water systems in the study area that exceed the nitrate drinking water MCL (serving an estimated 220,000 people). The annualized cost of providing nitrate-compliant drinking water to an estimated 10,000 affected rural households (34,000 people) using private domestic wells or local small water systems is estimated to be at least $2.5 million for point-of-use treatment for drinking use only. The total cost for alternative solutions translates to $80 to $142 per affected person per year, $5 to $9 per irrigated acre per year, or $100 to $180 per ton of fertilizer nitrogen applied in these groundwater basins.

Findings: Regulatory, Funding, and Policy Options

To date, regulatory actions have been insufficient to control nitrate contamination of groundwater. Many options exist to regulate nitrate loading to groundwater, with no ideal solution. Nitrate source reductions will improve drinking water quality only after years to decades. Fertilizer regulations have lower monitoring and enforcement costs and information requirements than do nitrate leachate regulations, but they achieve nitrate reduction targets less directly. Costs to farmers can be lower with fertilizer fees or market-based regulations than with technology mandates or prescriptive standards. Market-based approaches may also encourage the development and adoption of new technologies to reduce fertilizer use.

Current funding programs cannot ensure safe drinking water in the Salinas Valley and Tulare Lake Basin. Small water system costs are high, and some of these systems already face chronic financial problems. Most current state funding for nitrate contamination problems is short term. Little funding is provided for regionalization and consolidation of drinking water systems. Policy options exist for long-term funding of safe drinking water, but all existing and potential options will require someone to bear the costs.

Promising Actions

Addressing groundwater nitrate contamination requires actions in four areas: (a) safe drinking water actions for affected areas, (b) reducing sources of nitrate contamination to groundwater, (c) monitoring and assessment of groundwater and drinking water, and (d) revenues to help fund solutions. Promising actions for legislative and state agency consideration in these areas appear below (see also Table ES-1). Starred (*) actions do not appear to require legislative action, but might benefit from it.

Safe Drinking Water Actions (D)

Safe drinking water actions are the most effective and economical short- and long-term approach to address nitrate contamination problems in the Tulare Lake Basin and Salinas Valley. These actions apply especially to small and self-supplied household water systems, which face the greatest financial and public health problems from nitrate groundwater contamination.

D1: Point-of-Use (POU) Treatment Option. CDPH reports on how to make economical household and point-of-use treatment for nitrate contamination an available and permanent solution for small water systems.*

D2: Small Water System Task Force. CalEPA and CDPH convene an independently led Task Force on Small Water Systems that would report on problems and solutions of small water and wastewater systems statewide as well as the efficacy of various state, county, and federal programs to aid small water and wastewater systems. Many nitrate contamination problems are symptomatic of the broad problems of small water and wastewater systems.*

D3: Regional Consolidation. CDPH and counties provide more legal, technical, and funding support for preparing consolidation of small water systems with nearby larger systems and creating new, regional safe drinking water solutions for groups of small water systems, where cost-effective.*

D4: Domestic Well Testing. In areas identified as being at risk for nitrate contamination by the California Water Boards, as a public health requirement, CDPH (a) mandates periodic nitrate testing for private domestic wells and local and state small systems and (b) requires disclosure of recent well tests for nitrate contamination on sales of residential property. County health departments also might impose such requirements.

D5: Stable Small System Funds. CDPH receives more stable funding to help support capital and operation and maintenance costs for new, cost-effective and sustainable safe drinking water solutions, particularly for disadvantaged communities (DACs).

Source Reduction Actions (S)

Reducing nitrate loading to groundwater is possible, sometimes at a modest expense. But nitrate source reduction works slowly and cannot effectively restore all affected aquifers to drinking water quality. Within the framework of Porter-Cologne, unless groundwater were to be de-designated as a drinking water source, reduction of nitrate loading to groundwater is required to improve long-term water quality. The following options seem most promising to reduce nitrate loading.

S1: Education and Research. California Department of Food and Agriculture (CDFA), in cooperation with the University of California and other organizations, develops and delivers a comprehensive educational and technical program to help farmers improve efficiency in nitrogen use (including manure) and reduce nitrate loading to groundwater. This could include a groundwater nitrate–focused element for the existing CDFA Fertilizer Research and Education Program, including “pump-and-fertilize” remediation and improved recharge options for groundwater cleanup.*

S2: Nitrogen Mass Accounting Task Force. CalEPA establishes a Task Force, including CDFA, to explore nitrogen mass balance accounting methods for regulating agricultural land uses in areas at risk for nitrate contamination, and to compare three long-term nitrogen source control approaches: (a) a cap and trade system; (b) farm-level nutrient management plans, standards, and penalties; and (c) nitrogen fertilizer fees.*

S3: Fertilizer Excise Fee. Significantly raising the cost of commercial fertilizer through a fee or excise tax would fund safe drinking water actions and monitoring and give further incentive to farmers for reducing nitrate contamination. An equivalent fee or excise tax could be considered for organic fertilizer sources (manure, green waste, wastewater effluent, biosolids, etc.).

S4: Higher Fertilizer Fee in Areas at Risk. Areas declared to be at risk for nitrate contamination might be authorized to maintain a higher set of excise fees on nitrogen fertilizer applications (including synthetic fertilizer, manure, waste effluent, biosolids, and organic amendments), perhaps as part of a local safe drinking water compensation agreement.

Monitoring and Assessment (M)

Monitoring and assessment is needed to better assess the evolving nitrate pollution problem and the effectiveness of safe drinking water and nitrate source loading reduction actions. Such activities should be integrated with other state agricultural, environmental, and land use management; groundwater data; and assessment programs (source loading reduction actions)—along with other drinking water, treatment, and wastewater management programs (safe drinking water actions).

M1: Define Areas at Risk. Regional Water Boards designate areas where groundwater sources of drinking water are at risk of being contaminated by nitrate.*

M2: Monitor at-Risk Population. CDPH and the State Water Board, in coordination with DWR and CDFA, issue a report every 5 years to identify populations at risk of contaminated drinking water and to monitor long-term trends of the state’s success in providing safe drinking water as a supplement to the California Water Plan Update.*

M3: Learn from Department of Pesticide Regulation Programs. CalEPA and CDFA examine successful DPR data collection, analysis, education, and enforcement programs for lessons in managing nitrogen and other agricultural contaminants, and consider expanding or building upon the existing DPR program to include comprehensive nitrogen use reporting to support nitrate discharge management.*

M4: Groundwater Data Task Force. CalEPA , in coordination with CalNRA and CDPH, convenes an independently led State Groundwater Data Task Force to examine the efficacy of current state and local efforts to collect, maintain, report, and use groundwater data for California’s groundwater quality and quantity problems.

M5: Groundwater Task Force. CalEPA, CalNRA, and CDPH maintain a joint, permanent, and independently led State Groundwater Task Force to periodically assess and coordinate state technical and regulatory groundwater programs in terms of effectiveness at addressing California’s groundwater quality and quantity problems. These reports would be incorporated into each California Water Plan Update.*

Funding (F)

Little effective action can occur without funding. Four funding options seem most promising, individually or in combination. State funding from fees on nitrogen or water use, which directly affect nitrate groundwater contamination, seem particularly promising and appropriate.

F1: Mill Fee. Increase the mill assessment rate on nitrogen fertilizer to the full authorized amount (CAL. FAC Code Section 14611). This would raise roughly $1 million/year statewide and is authorized for fertilizer use research and education.*

F2: Local Compensation Agreements. Regional Water Boards can require and arrange for local compensation of affected drinking water users under Porter-Cologne Act Water Code Section 13304. Strengthening existing authority, the Legislature could require that a Regional Water Board finding that an area is at risk of groundwater nitrate contamination for drinking water be accompanied by a cleanup and abatement order requiring overlying, current sources of nitrate to financially support safe drinking water actions acceptable to the local County Health Department. This might take the form of a local “liability district.”*

F3: Fertilizer Excise Fee. Introduce a substantial fee on nitrogen fertilizer sales or use, statewide or regionally, to fund safe drinking water actions, nitrate source load reduction efforts, and nitrate monitoring and assessment programs.

F4: Water Use Fee. A more comprehensive statewide fee on water use could support many beneficial activities. Some of such revenues could fund management and safe drinking water actions in areas affected by nitrate contamination, including short-term emergency drinking water measures for disadvantaged communities.

Table ES-1. Likely performance of promising state and agency actions for nitrate groundwater contamination.

Action	Safe Drinking Water	Groundwater Degradation	Economic Cost
No Legislation Required			
Safe Drinking Water Actions			
D1: Point-of-Use Treatment Option for Small Systems +	♦♦		low
D2: Small Water Systems Task Force +	♦		low
D3: Regionalization and Consolidation of Small Systems +	♦♦		low
Source Reduction Actions			
S1: Nitrogen/Nitrate Education and Research +		♦♦♦	low–moderate
S2: Nitrogen Accounting Task Force +		♦♦	low
Monitoring and Assessment			
M1: Regional Boards Define Areas at Risk +	♦♦♦	♦♦♦	low
M2: CDPH Monitors At-Risk Population +	♦	♦	low
M3: Implement Nitrogen Use Reporting +		♦♦	low
M4: Groundwater Data Task Force +	♦	♦	low
M5: Groundwater Task Force +	♦	♦	low
Funding			
F1: Nitrogen Fertilizer Mill Fee		♦♦♦	low
F2: Local Compensation Agreements for Water +	♦♦	♦	moderate
New Legislation Required			
D4: Domestic Well Testing *	♦♦		low
D5: Stable Small System Funds	♦		moderate
Non-tax legislation could also strengthen and augment existing authority.			
Fiscal Legislation Required			
Source Reduction			
S3: Fertilizer Excise Fee	♦♦	♦	moderate
S4: Higher Fertilizer Fee in Areas at Risk	♦	♦	moderate
Funding Options			
F3: Fertilizer Excise Fee	♦♦	♦♦	moderate
F4: Water Use Fee	♦♦	♦♦	moderate

♦ Helpful

♦♦ Effective

♦♦♦ Essential

+ Legislation would strengthen.

* County health departments may have authority; CDPH requires legislation.

1 Introduction

The development of California's tremendous economy has not been without environmental costs. Since early in the twentieth century, nitrate from agricultural and urban activities has slowly infiltrated into groundwater. Nitrate has accumulated and spread and will continue to make its way into drinking water supplies. The time lag between the application of nitrogen to the landscape and its withdrawal at household and community public water supply wells, after percolating through soils and groundwater, commonly extends over decades.

This Report is an overview of groundwater contamination by nitrate in the Tulare Lake Basin and Salinas Valley. We examine the extent, causes, consequences, and costs of this contamination, as well as how it will likely develop over time. We also examine management and policy actions available for this problem, including possible nitrate source reduction, provisions for safe drinking water, monitoring and assessment, and aquifer remediation actions. The costs and institutional complexities of these options, and how they might be funded, also are addressed.

Addressing nitrate contamination problems in the Tulare Lake Basin and Salinas Valley will require decades to resolve, driven by the pace of groundwater flow and the response times of humans and institutions on the surface. Nitrate in drinking water today is a legacy contaminant, but years and decades from now the nitrate in drinking water will be from today's discharges. Assistance and management to improve drinking water supplies in response to nitrate contamination is a central and urgent policy issue for the State of California. Another major policy issue is the inevitability of widespread groundwater degradation for decades to come, despite even heroic (and ultimately expensive) efforts to reduce nitrate loading into aquifers. This introduction attempts to put the issue in a larger context.

Groundwater is essential to California. Groundwater is vital for California's agricultural, industrial, urban, and drinking water uses. Depending on drought conditions, groundwater provides between one-third and nearly one-half of the state's water supplies. As a source of drinking water, groundwater serves people from highly dispersed rural communities to densely populated cities. More than 85% of community public water systems in California (serving 30 million residents) rely on groundwater for at least part of their drinking water supply. In addition, approximately 2 million residents rely on groundwater from either a private domestic well or a smaller water system not regulated by the state (State Water Board 2011). Intensive agricultural production, population growth, and—indirectly—partial restoration of environmental instream flows have led to groundwater overdraft (Hanak et al. 2011). More protective health-based water quality standards for naturally occurring water quality constituents and groundwater contamination from urban and agricultural activities pose serious challenges to managing the state's drinking water supply.

Nitrate is one of California's most widespread groundwater contaminants. Nitrate is among the most frequently detected contaminants in groundwater systems around the world, including the extensively tapped aquifers in California's Central Valley and Salinas Valley (Figure 1) (Spalding and Exner 1993; Burow et al. 2010; Dubrovsky et al. 2010; MCWRA 2010; Sutton et al. 2011). Nitrate contamination poses an environmental health risk because many rural areas obtain drinking water from wells that are often shallow and vulnerable to contamination (Guillette and Edwards 2005; Fan and Steinberg 1996).

High levels of nitrate affect human health. Infants who drink water (often mixed with baby formula) containing nitrate in excess of the maximum contaminant level (MCL) for drinking water may quickly become seriously ill and, if untreated, may die because high nitrate levels can decrease the capacity of an infant's blood to carry oxygen (methemoglobinemia, or "blue baby syndrome"). High nitrate levels may also affect pregnant women and adults with hereditary cytochrome b5 reductase deficiency. In addition, nitrate and nitrite ingestion in humans has been linked to goitrogenic (anti-thyroid) actions on the thyroid gland (similar to perchlorate), fatigue and reduced cognitive functioning due to chronic hypoxia, maternal reproductive complications including spontaneous abortion, and a variety of carcinogenic outcomes deriving from N-nitrosamines formed via gastric nitrate conversion in the presence of amines (Ward et al. 2005).

Nitrate is part of the natural nitrogen cycle in the environment. Groundwater nitrate is part of the global nitrogen cycle. Like other key elements essential for life, nitrogen flows through the environment in a dynamic cycle that supports organisms ranging from microbes to plants to animals. Plants require nitrogen for growth, and scarcity of fixed soil nitrogen often limits plant growth. Specialized microorganisms can fix atmospheric elemental nitrogen and make it available for plants to use for photosynthesis and growth. The natural nitrogen cycle is a dynamic balance between elemental nitrogen in the atmosphere and reactive forms of nitrogen moving through the soil-plant-animal-water-atmosphere cycle of ecosystems globally. Production of synthetic nitrogen fertilizer has disrupted this balance.

Nitrogen is key to global food production. Modern agricultural practices, using synthetically produced nitrogen fertilizer, have supplied the nitrogen uses of plants to increase food, fiber, feed, and fuel production for consumption by humans and livestock. Agricultural production is driven by continued global growth in population and wealth, which increases demand for agricultural products, particularly high-value agricultural products such as those produced in California. Global food, feed, and fiber demands are anticipated to increase by over 70% over the next 40 years (Tilman et al. 2002; De Fraiture et al. 2010).

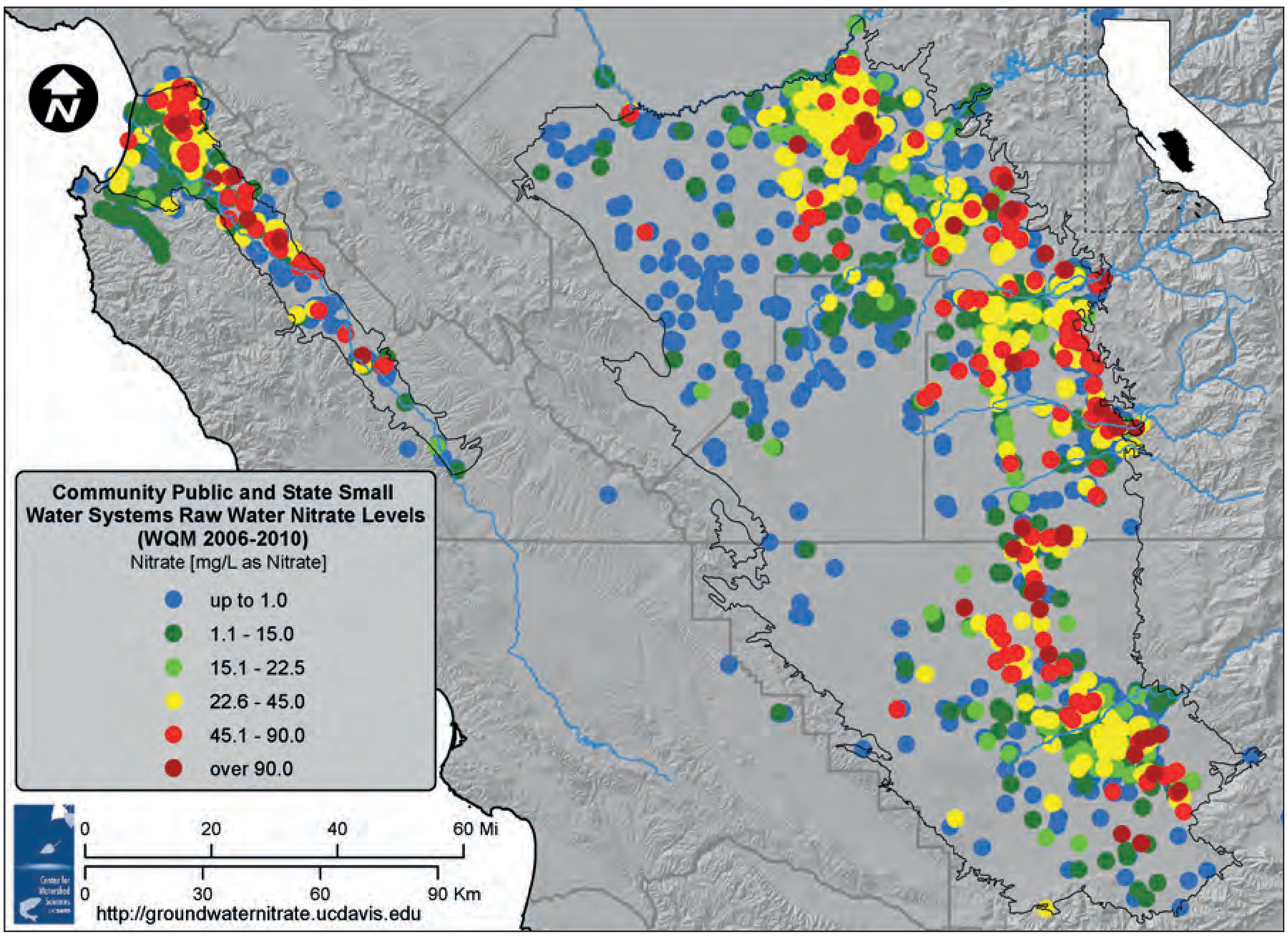


Figure 1. Maximum reported raw-level nitrate concentration in community public water systems and state-documented state small water systems, 2006–2010. Source: CDPH PICME WQM Database (see Honeycutt et al. 2011).

Intensive agriculture and human activities have increased nitrate concentrations in the environment. Greater use of nitrogen-based fertilizers, soil amendments such as manure, and nitrogen-fixing cover crops add nitrogen to deficient soils and dramatically raise crop yields. Technological advances in agriculture, manufacturing, and urban practices have increased levels of reactive forms of nitrogen, including nitrate, released into the atmosphere, into surface water, and into groundwater. The nearly 10-fold increase of reactive nitrogen creation related to human activities over the past 100 years (Galloway and Cowling 2002) has caused a wide range of adverse ecological and environmental impacts (Davidson et al. 2012).

The most remarkable impacts globally include the leaching of nitrate to groundwater; the eutrophication of surface waters and resultant marine "dead zones"; atmospheric deposition that acidifies ecosystems; and the emission of nitrogen oxides (NOx) that deplete stratospheric ozone (Keeney and Hatfield 2007; Beever et al. 2007; Foley et al. 2005). These widespread environmental changes also can threaten human health (Galloway et al. 2008; Guillette and Edwards 2005; Galloway et al. 2004; Townsend et al. 2003; Vitousek et al. 1997; Fan and Steinberg 1996; Jordan and Weller 1996).

California has decentralized regulatory responsibility for groundwater nitrate contamination. Nitrate contamination of groundwater affects two state agencies most directly. Sources of groundwater nitrate are regulated under California's Porter-Cologne Water Quality Control Act (Porter-Cologne) administered through the State Water Resources Control Board (State Water Board) and the Regional Water Quality Control Boards (Regional Water Boards). State Water Board Resolution 88-63 designates drinking water as a beneficial use in nearly all of California's major aquifers. Under the Porter-Cologne Act, dischargers to groundwater are responsible, first, for preventing adverse effects on groundwater as a source of drinking water, and second, for cleaning up groundwater when it becomes contaminated.

Drinking water in public water systems (systems with at least 15 connections or serving at least 25 people for 60 or more days per year) is regulated by CDPH under the federal Safe Drinking Water Act of 1972 (SWDA). CDPH has set the nitrate MCL in drinking water at 45 mg/L (10 mg/L as nitrate-N). If nitrate levels in public drinking water supplies exceed the MCL standard, mitigation measures must be employed by water purveyors to provide a safe supply of drinking water to the population at risk.

The California Department of Food and Agriculture (CDFA) and the Department of Water Resources (DWR) also have roles in nitrate management. The DWR is charged with statewide planning and funding efforts for water supply and water quality protection, including the funding of Integrated Regional Water Management Plans and DWR's management of urban and agricultural water use efficiency. CDFA collects data, funds research, and promotes education regarding the use of nitrogen fertilizers and other nutrients in agriculture.

SBX2 1 Nitrate in Groundwater Report to Legislature. In 2008, the California legislature enacted Senate Bill SBX2 1 (Perata), which created California Water Code Section 83002.5. The bill requires the State Water Board to prepare a Report to the Legislature (within 2 years of receiving funding) to "improve understanding of the causes of [nitrate] groundwater contamination, identify potential remediation solutions and funding sources to recover costs expended by the state for the purposes of this section to clean up or treat groundwater, and ensure the provision of safe drinking water to all communities." Specifically, the bill directs the State Water Board to

> identify sources, by category of discharger, of groundwater contamination due to nitrate in the pilot project basins; to estimate proportionate contributions to groundwater contamination by source and category of discharger; to identify and analyze options within the board's current authority to reduce current nitrate levels and prevent continuing nitrate contamination of these basins and estimate the costs associated with exercising existing authority; to identify methods and costs associated with the treatment of nitrate contaminated groundwater for use as drinking water; to identify methods and costs to provide an alternative water supply to groundwater reliant communities in each pilot project basin; to identify all potential funding sources to provide resources for the cleanup of nitrate, groundwater treatment for nitrate, and the provision of alternative drinking water supply, including, but not limited to, State bond funding, federal funds, water rates, and fees or fines on polluters; and to develop recommendations for developing a groundwater cleanup program for the Central Valley Water Quality Control Region and the Central Coast Water Quality Control Region based upon pilot project results.

The bill designates the groundwater basins of the Tulare Lake Basin region and the Monterey County portion of the Salinas Valley as the selected pilot project areas. In June 2010, the State Water Board contracted with the University of California, Davis, to prepare this Report for the Board as background for its Report to the Legislature.

Project area is relevant to all of California. The project area encompasses all DWR Bulletin 118 designated groundwater sub-basins of the Salinas River watershed that are fully contained within Monterey County, and the Pleasant Valley, Westside, Tulare Lake Bed, Kern, Tule River, Kaweah River, and Kings River groundwater sub-basins of the Tulare Lake Basin. The study area—2.3 million ha (5.7 million ac) in size—is home to approximately 2.65 million people, almost all of whom rely on groundwater as a source of drinking water. The study area includes four of the nation's five counties with the largest agricultural production; 1.5 million ha (3.7 million ac) of irrigated cropland, representing about 40% of California's irrigated cropland; and more than half of California's dairy herd. More than 80 different crops are grown in the study area (Figure 2). This is also one of California's poorest regions: many census blocks with significant population belong to the category of severely disadvantaged communities (less than 60% of the state's median household income), and many of the remaining populated areas are disadvantaged communities (less than 80% of the state's median household income). These communities have little economic means and technical capacity to maintain safe public drinking water systems given contamination from nitrate and other contaminants in their drinking water sources.

Report excludes assessment of public health standards for nitrate. Public health and appropriateness of the drinking water limits are prescribed by CDPH and by U.S. EPA under SDWA. The scope of SBX2 1 precluded a review of the public health aspects or a review of the appropriateness of the nitrate MCL, although this is recognized as an important and complex aspect of the nitrate contamination issue (Ward et al. 2005).

"Report for the State Water Resources Control Board Report to the Legislature" and supporting Technical Reports. This Report for the State Water Board Report to the Legislature ("Report") has been provided in fulfillment of the University of California, Davis, contract with the State Water Board. This Report provides an overview of the goals of the research, methods, and key findings of our work, and is supported by eight related Technical Reports (Harter et al. 2012; Viers et al. 2012; Dzurella et al. 2012; Boyle et al. 2012; King et al. 2012; Jensen et al. 2012; Honeycutt et al. 2012; and Canada et al. 2012). The Technical Reports provide detailed information on research methods, research results, data summaries, and accompanying research analyses that are important for evaluating our results and findings and for applying our approach and results to other groundwater basins.

The Report takes a broad yet quantitative view of the groundwater nitrate problem and solutions for this area and reflects collaboration among a diverse, interdisciplinary team of experts. In its assessment, the Report spans institutional and governmental boundaries. The Report quantifies the diverse range of sources of groundwater nitrate. It reviews the current groundwater quality status in the project area by compiling and analyzing all available data from a variety of institutions. It then identifies source reduction, groundwater remediation, drinking water treatment, and alternative drinking water supply alternatives, along with the costs of these options. Descriptions and summaries are also included of current and potential future funding options and regulatory measures to control source loading and provide safe drinking water, along with their advantages, disadvantages, and potential effectiveness.

This set of Reports is the latest in a series of reports on nitrate contamination in groundwater beginning in the 1970s (Schmidt 1972; Report to Legislature 1988; Dubrovsky et al. 2010; U.S. EPA 2011). This Report has some of the same conclusions as previous reports but takes a much broader perspective, contains more analysis, and perhaps provides a wider range of promising actions.

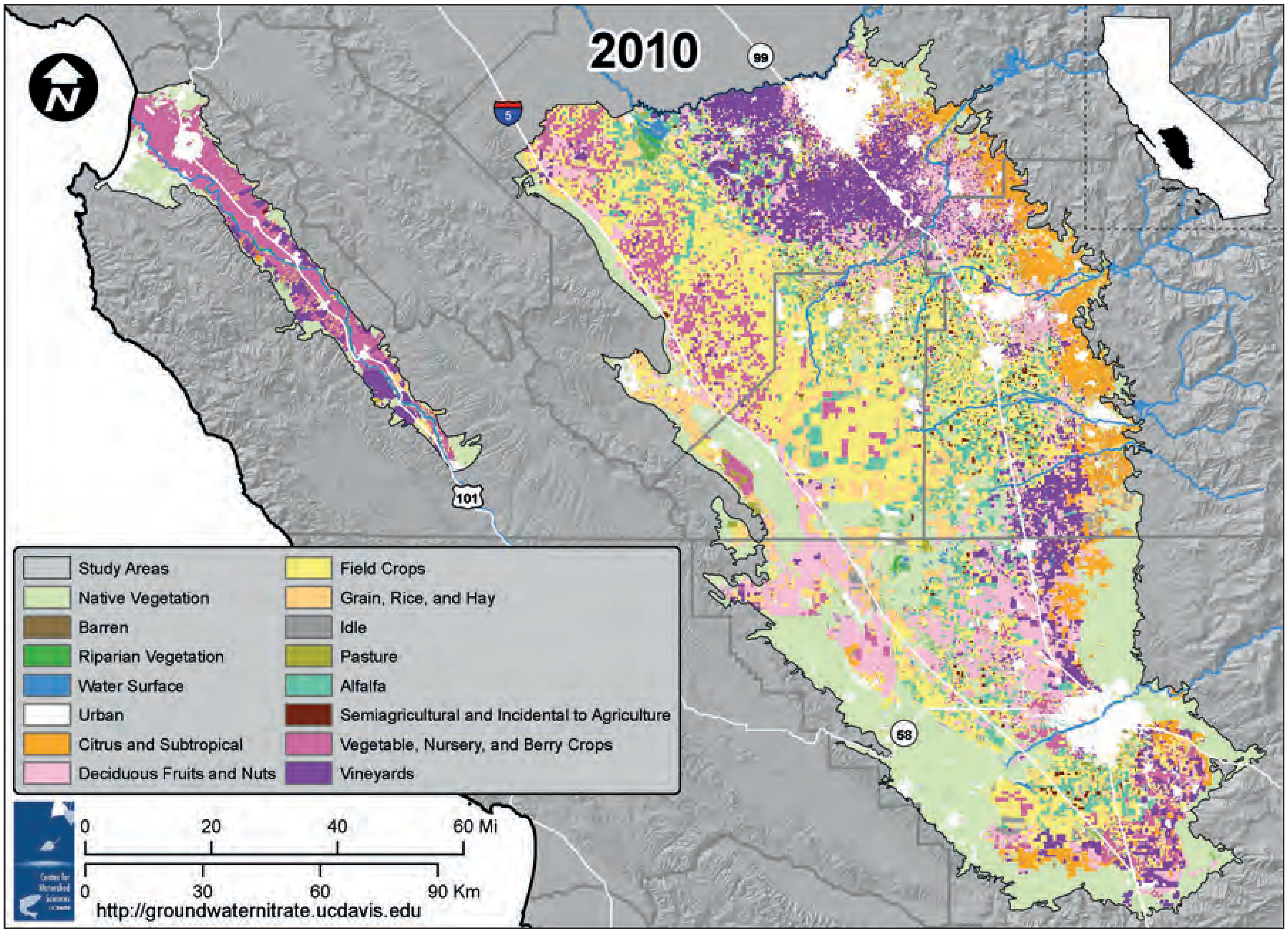
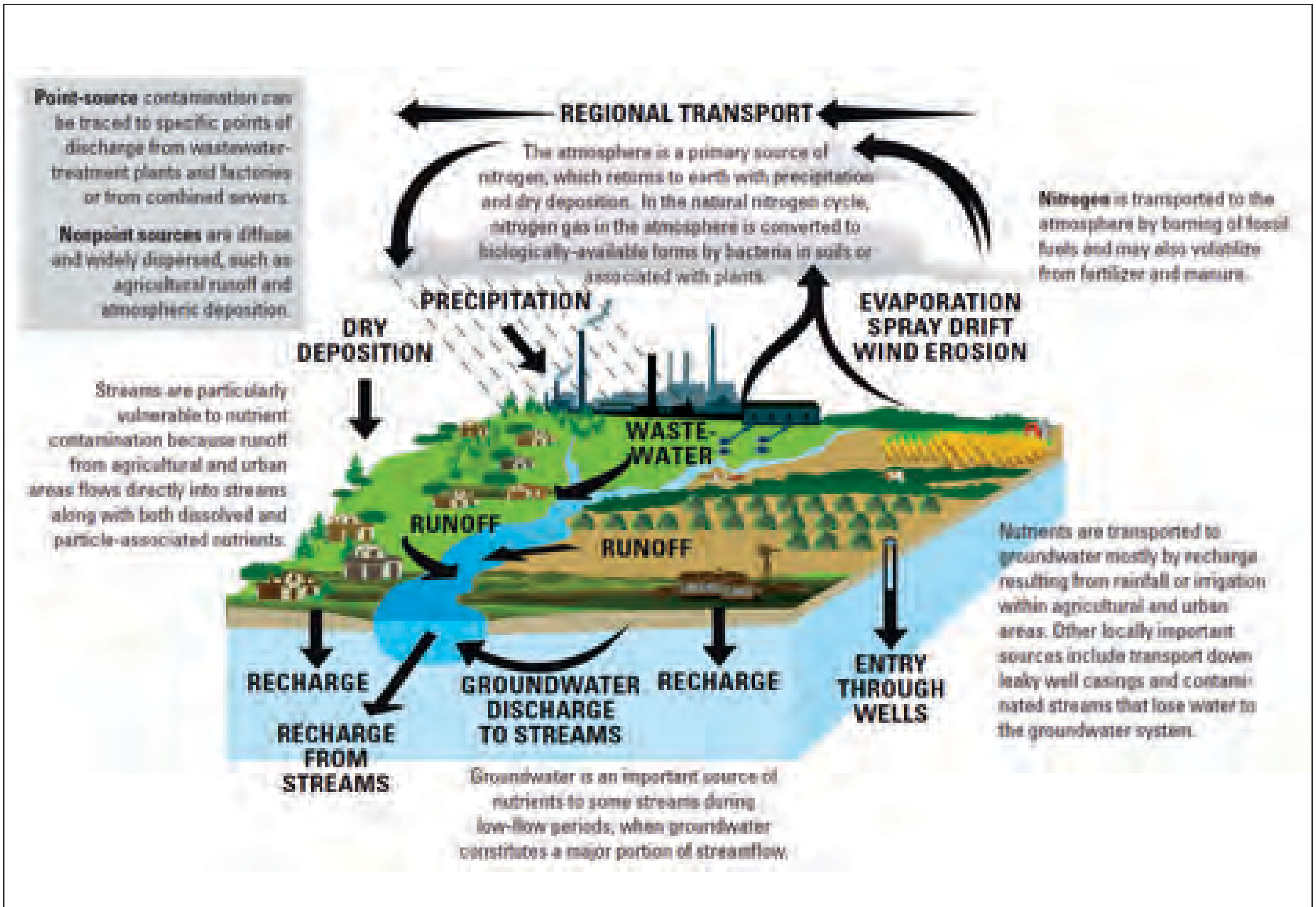


Figure 2. The Tulare Lake Basin (TLB) and Salinas Valley (SV) are the focus of this study. The study area represents 40% of California's diverse irrigated agriculture and more than half of its confined animal farming industry. It is home to 2.6 million people, with a significant rural population in economically disadvantaged communities. Source: Viers et al. 2012.



Source: Dubrovsky et al. 2010.

2 Sources of Groundwater Nitrate

2.1 Nitrogen Cycle: Basic Concepts

Nitrogen is an essential element for all living organisms. Nitrogen cycles through the atmosphere, hydrosphere, and biosphere. The dominant gas (78%) in the atmosphere is highly stable (inert) N_2 gas. Biological nitrogen fixation transforms N_2 gas into ammonia (NH_3), which is rapidly converted to the forms of nitrogen needed for plant growth. Nitrogen fixation is performed only by specialized soil and aquatic microbes. Other living organisms cannot use inert atmospheric N_2 directly but rely on accumulated soil organic matter, plants, animals, and microbial communities for nitrogen.

Soil nitrogen is most abundant in the organic form (N_{org}). Mineralization is a suite of processes performed by soil microbes that converts organic nitrogen to inorganic forms of nitrogen. The rates of mineralization depend on the environmental conditions such as temperature, moisture, pH, and oxygen content, as well as the type of organic matter available. The first product of mineralization is ammonium (NH_4^+), but under aerobic conditions, microbes can convert ammonium (NH_4^+) first to nitrite (NO_2^-) and then to nitrate (NO_3^-). Most plants use nitrate or ammonium as their preferred source of nitrogen (White 2006). Immobilization is the reverse of mineralization in that soil ammonium and nitrate are taken up by soil organisms and plants and converted into N_{org}.

The ultimate fate of "reactive" nitrogen (organic nitrogen, ammonium, nitrate, ammonia, nitrous oxide, etc.) is to return back to the atmosphere as N_2. For nitrate, this is a microbially mediated process ("denitrification") that requires an anoxic (i.e., oxygen-free) environment.

Groundwater is becoming a growing component of the global nitrogen cycle because of the increased nitrogen inflows and because of long groundwater residence times. Nitrate does not significantly adhere to or react with sediments or other geologic materials, and it moves with groundwater flow. Other forms of reactive nitrogen in groundwater are less significant and much less mobile: ammonia occurs under some groundwater conditions, but it is subject to sorption and rapidly converts to nitrate under oxidizing conditions. Dissolved organic nitrogen (DON) concentrations are generally much less than those of nitrate, except near wastewater sources, due to the high adsorption of DON to aquifer materials.

Groundwater nitrate inputs may come from natural, urban, industrial, and agricultural sources. Groundwater nitrate outputs occur through wells or via discharge to springs, streams, and wetlands. Discharge to surface water sometimes involves denitrification or reduction of nitrate to ammonium when oxygen-depleted conditions exist beneath wetlands and in the soils immediately below streams.

2.2 Sources of Nitrate Discharge to Groundwater

Nitrogen enters groundwater at varying concentrations and in varying forms (organic nitrogen, ammonium, nitrate) with practically all sources of recharge: diffuse recharge from precipitation and irrigation; focused recharge from streams, rivers, and lakes; focused recharge from recharge basins and storage lagoons; and focused recharge from septic system drainfields. Across major groundwater basins in California, diffuse recharge from irrigation, stream recharge, and intentional recharge are the major contributors to groundwater. Since groundwater is an important reservoir for long-term water storage, recharge is extremely important and desirable in many areas. Controlling nitrate in recharge and managing recharge are therefore key to nitrate source control.

Current groundwater nitrate, its spatial distribution, and its changes over time are the result of recent as well as historical nitrate loading. To understand current and future groundwater conditions requires knowledge of historical, current, and anticipated changes in land use patterns, recharge rates, and nitrate loading rates (Viers et al. 2012).

Natural Nitrate Sources

Nitrate occurs naturally in many groundwaters but at levels far below the MCL for drinking water (Mueller and Helsel 1996). The main potential sources of naturally occurring nitrate are bedrock nitrogen and nitrogen leached from natural soils. Surface water nitrate concentrations can be elevated in areas with significant bedrock nitrogen (Holloway et al. 1998), but they are not high enough to be a drinking water concern. During the early twentieth century, conversion of the study area's semiarid and arid natural landscape to irrigated agriculture may have mobilized two additional, naturally occurring sources of nitrate. First, nitrate was released from drained wetlands at the time of land conversion due to increased microbial activity in agricultural soils; stable organic forms of nitrogen that had accumulated in soils over millennia were converted to mobile nitrate. Second, nitrate salts that had accumulated over thousands of years in the unsaturated zone below the grassland and desert soil root zone due to lack of significant natural recharge were mobilized by irrigation (Dyer 1965; Stadler et al. 2008; Walvoord et al. 2003). However, the magnitude of these sources (Scanlon 2008) is considered to have negligible effects on regional groundwater nitrate given the magnitude of human sources.

Human Nitrate Sources

Anthropogenic groundwater nitrate sources in the study area include agricultural cropland, animal corrals, animal manure storage lagoons, wastewater percolation basins at municipal wastewater treatment plants (WWTPs) and food processors (FPs), septic system drainfields (onsite sewage systems), leaky urban sewer lines, lawns, parks, golf courses, and dry wells or percolation basins that collect and recharge stormwater runoff. Incidental leakage of nitrate may also occur directly via poorly constructed wells. Croplands receive nitrogen from multiple inputs: synthetic fertilizer, animal manure, WWTP and FP effluent, WWTP biosolids, atmospheric deposition, and nitrate in irrigation water sources.

Source categories. For this Report, we estimated the groundwater nitrate contributions for 58 individual agricultural cropland categories, for animal corrals, for manure lagoons, for each individual WWTP and FP within the study area, for dairies and other animal farming operations, for septic system drainfields, and for urban sources. Contributions from dry wells and incidental leakage through existing wells were estimated at the basin scale. Groundwater nitrate contributions were estimated for five time periods, each consisting of 5 years: 1943–1947 (“1945”), 1958–1962 (“1960”), 1973–1977 (“1975”), 1988–1992 (“1990”), and 2003–2007 (“2005”); the latter is considered to be current. Future year 2050 loading was estimated based on anticipated land use changes (primarily urbanization). These categorical or individual estimates of nitrate leaching lead to maps that show nitrate discharge at a resolution of 0.25 ha (less than 1 ac) for the entire study area and its changes over a period of 105 years (1945–2050) (Viers et al. 2012; Boyle et al. 2012).

Separately, we also aggregated nitrate loads to groundwater

- by crop categories (e.g., olives, persimmons, lettuce, strawberries) and crop groups (e.g., “subtropicals,” “vegetables and berries”) averaged or summed over the entire study area;
- by county, totaled across all cropland, all WWTPs and FPs, all dairies, all septic drains, and all municipal areas; and
- summed or averaged for the study area.

Higher levels of aggregation provide more accurate estimates but are less descriptive of actual conditions at any given location. Aggregated totals are most useful for policy and planning.

We report nitrate loading to groundwater in two ways:

- Total annual nitrate leached to groundwater, measured in gigagrams of nitrate-nitrogen per year (Gg N/yr).[1] As a practical measure, 1 gigagram is roughly equivalent to $1 million of nitrogen fertilizer at 2011 prices.
- Intensity of the nitrate leaching to groundwater, measured in kilograms of nitrate-nitrogen per ha of use per year (kg N/ha/yr) [lb per acre per year, lb/ac/yr], which represents the intensity of the source at its location (field, pond, corral, census block, city) and its potential for local groundwater pollution.

How much nitrate loading to groundwater is acceptable? To provide a broad reference point of what the source loading numbers mean with respect to potential groundwater pollution, it is useful to introduce an operational benchmark that indicates whether nitrate leached in recharge to groundwater exceeds the nitrate drinking water standard. This operational benchmark considers that nearly all relevant anthropogenic nitrate sources provide significant groundwater recharge and therefore remain essentially undiluted when

[1] One gigagram is equal to 1 million kilograms (kg), 1,000 metric tons, 2.2 million pounds (lb), or 1,100 tons (t). In this report, nitrogen application to land refers to total nitrogen (organic nitrogen, ammonium-nitrogen, and nitrate-nitrogen). For consistency and comparison, total nitrate loading and the intensity of nitrate loading from the root zone to groundwater are also provided in units of nitrogen, not as nitrate. However, concentrations of nitrate in groundwater or leachate are always stated as nitrate (MCL: 45 mg/L) unless noted otherwise.

reaching groundwater. Our benchmark for "low" intensity versus "high" intensity of nitrate leaching is 35 kg N/ha/yr (31 lb N/ac/yr).[2] Aggregated across the 1.5 million ha (3.7 million ac) of cropland, the benchmark for total annual nitrate loading in the study area is 50 Gg N/yr (55,000 t N/yr). Total nitrate loading to groundwater above this benchmark indicates a high potential for regional groundwater degradation.

Estimating nitrate loading by source category. We used two methods to assess nitrate loading:

- a mass balance approach was used to estimate nitrate loading from all categories of cropland except alfalfa;
- alfalfa cropland and nitrate sources other than cropland were assessed by reviewing permit records, literature sources, and by conducting surveys to estimate groundwater nitrate loading (Viers et al. 2012).

Groundwater Nitrate Contributions by Source Category

Cropland is by far the largest nitrate source, contributing an estimated 96% of all nitrate leached to groundwater (Table 1). The total nitrate leached to groundwater (200 Gg N/yr [220,000 t N/yr]) is four times the benchmark amount, which suggests large and widespread degradation of groundwater quality. Wastewater treatment plants and food processor waste percolation basins are also substantial, high-intensity sources.[3] Septic systems, manure storage lagoons, and corrals are relatively small sources basin-wide, but since their discharge intensity significantly exceeds the operational benchmark of 35 kg N/ha/yr (31 lb N/ac/yr), these source categories can be locally important. The magnitude and intensity of urban sources (other than septic systems) does not suggest widespread impact to groundwater (Viers et al. 2012). The following sections provide further detail on these sources.

Agricultural Sources

Cropland sources: Overview. The five counties in the study area include 1.5 million ha (3.7 million ac) of cropland, about 40% of California's irrigated cropland. Agricultural production involves many crops and significant year-to-year changes in crops grown and crop yields. The dominant crop groups in the project area include subtropical crops (citrus and olives), tree fruits and nuts, field crops including corn and cotton, grain crops, alfalfa, vegetables and strawberries, and grapes (see Figure 2). The study area also supports 1 million dairy cows. These produce one-tenth of the nation's milk supply as well as large amounts of manure.

Cropland sources: Alfalfa. The mass balance approach is not applied to alfalfa because it does not receive significant amounts of fertilizer, yet alfalfa fixes large amounts of nitrogen from the atmosphere. Little is known about nitrate leaching from alfalfa; we used a reported value of 30 kg N/ha/yr (27 lb N/ac/yr) (Viers et al. 2012). In total, 170,000 ha (420,000 ac) of alfalfa fields are estimated to contribute about 5 Gg N/yr (5,500 t N/yr) in the study area. Alfalfa harvest exceeds 400 kg N/ha/yr (360 lb N/ac/yr), or 74 Gg N/yr (82,000 t N/yr), in the study area.

Cropland sources other than alfalfa. Unlike other groundwater nitrate source categories, cropland has many sources of nitrogen application, all of which can contribute to nitrate leaching. Principally, crops are managed for optimal harvest. Synthetic nitrogen is the fertilizer of choice to achieve this goal, except in alfalfa. Other sources of nitrogen are also applied to cropland, providing additional fertilizer, serving as soil amendments, or providing a means of waste disposal. These additional nitrogen sources include animal manure and effluent and biosolids from WWTPs, FPs, and other urban sources. Often do they replace synthetic fertilizer as the main source of nitrogen for a crop. Atmospheric deposition of nitrogen and nitrate in irrigation water are mostly incidental but ubiquitous.

For the mass balance analysis, external nitrogen inputs to cropland are considered to be balanced over the long run (5 years and more) by nitrogen leaving the field in crop harvest, atmospheric losses (volatilization, denitrification), runoff to streams, or groundwater leaching. Hence, cropland nitrate leaching to groundwater is estimated by summing nitrogen inputs to a field (fertilizer, effluent, biosolids,

[2] A typical groundwater recharge rate in the study area is roughly 300 mm/yr (1 AF/ac/yr). If that recharge contains nitrate at the MCL, the annual nitrate loading rate is 30 kg N/ha/yr (27 lb N/ac/yr). We allow an additional 5 kg N/ha/yr (4.5 lb N/ac/yr) to account for potential denitrification in the deep vadose zone or in shallow groundwater.

[3] The benchmark of 35 kg N/ha (31 lb N/ac) is not adequate for percolation basins, as their recharge rate is much more than 1 AF/ac. Instead, we consider actual average concentration (by county) of nitrogen in FP and WWTP discharges to percolation basins, which range from 2 to 10 times the MCL and 1 to 2 times the MCL, respectively (Viers et al. 2012).

manure, atmospheric deposition, irrigation water) and then subtracting the three other nitrogen outputs (harvest, atmospheric losses, and runoff).

In total, the 1.27 million ha (3.1 million ac) of cropland, not including 0.17 million ha (0.4 million ac) of alfalfa, receive 380 Gg N/yr (419,000 t N/yr) from all sources. Synthetic fertilizer, at 204 Gg N/yr (225,000 t N/yr), is more than half of these inputs (Figure 3). Manure applied on dairy forages or exported for cropland applications off-dairy (but not leaving the study area) is one-third of all nitrogen inputs. Atmospheric deposition and nitrate-nitrogen in groundwater used as irrigation water are approximately one-tenth of all nitrogen input. Urban effluent and biosolids application are small portions of the overall nitrogen input in the study area, but they are locally significant.

Table 1. Major sources of groundwater nitrate, their estimated total contribution in the study area, their percent of total contribution, and their estimated average local intensity, which indicates local pollution potential (actual total nitrate loading from these source categories is very likely within the range provided in parentheses)

	Total Nitrate Loading to Groundwater Gg N/yr* (range) [1,000 t N/yr (range)]	Percent Contribution to Total Nitrate Leaching in the Study Area	Average Intensity of Nitrate Loading to Groundwater kg N/ha/yr [lb N/ac/yr]
Cropland	195 (135–255) [215 (150–280)]	93.7%	154 [137]
Alfalfa cropland	5 (<1–10) [5 (<1–10)]	2.4%	30 [27]
Animal corrals	1.5 (0.5–8) [1.7 (0.5–9)]	0.7%	183 [163]
Manure storage lagoons	0.23 (0.2–2) [0.25 (0.2–2)]	0.1%	183 [163]
WWTP and FP† percolation basins	3.2 (2–4) [3.5 (2–4)]	1.5%	1,200‡ [1,070]
Septic systems	2.3 (1–4) [2.5 (1–4)]	1.1%	<10 – >50 [<8.8 – >45]
Urban (leaky sewers, lawns, parks, golf courses)	0.88 (0.1–2) [0.97 (0.1–2)]	0.5%	10 [8.8]
Surface leakage to wells	<0.4 [<0.4]	—	§

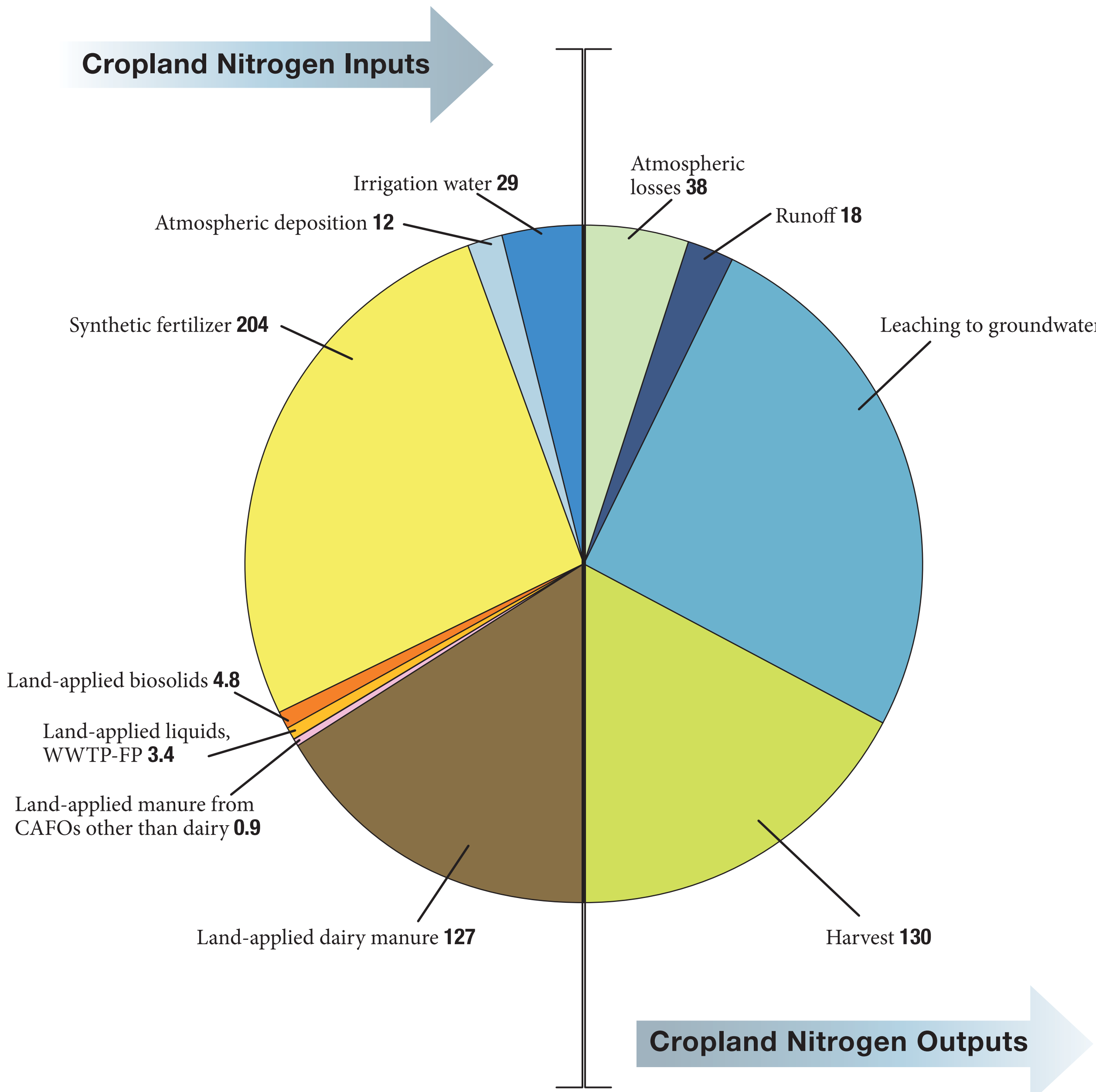
Source: Viers et al. 2012.

*At 2011 prices, 1 Gg N (1,100 t N) is roughly equivalent to $1 million in fertilizer nitrogen.

†WWTP = wastewater treatment plant; FP = food processor.

‡The benchmark of 35 kg N/ha/yr does not apply to WWTP and FP percolation basins, which may recharge significantly more water than other sources. Their nitrate loading may be high even if nitrate concentrations are below the MCL (Viers et al. 2012).

§Surface leakage through improperly constructed wells is based on hypothetical estimates and represents an upper limit.



Note: No mass balance was performed on 0.17 million ha (0.4 million ac) of nitrogen-fixing alfalfa, which is estimated to contribute an additional 5 Gg N/yr to groundwater. Groundwater nitrate loading from all non-cropland sources is about 8 Gg N/yr.

Figure 3. Overview of cropland input and output (Gg N/yr) in the study area (Tulare Lake Basin and Salinas Valley) in 2005. The left half of the pie chart represents total nitrogen inputs to 1.27 million ha (3.12 million ac) of cropland, not including alfalfa. The right half of the pie chart represents total nitrogen outputs with leaching to groundwater estimated by difference between the known inputs and the known outputs. Source: Viers et al. 2012.

On the output side, the total nitrate leaching to groundwater from cropland, not including alfalfa, comprises 195 Gg N/yr (215,000 t N/yr) and is by far the largest nitrogen flux from cropland, much larger than the harvested nitrogen at 130 Gg N/yr (143,000 t N/yr). The nitrogen leached to groundwater nearly matches the amount of synthetic fertilizer applied to the same cropland, suggesting large system surpluses of nitrogen use on cropland. Other outputs are small: atmospheric losses are assumed to be one-tenth of the inputs (Viers et al. 2012), and runoff is assumed to be 14 kg N/ha/yr (12.5 lb N/ac/yr) (Beaulac and Reckhow 1982).

Applying the benchmark of 50 Gg N/yr (55,000 t N/yr), groundwater leaching losses would need to be reduced by 150 Gg N/year (165,000 t N/yr) or more area-wide to avoid further large-scale groundwater degradation. Figure 3 suggests three major options to reduce nitrate loading to groundwater from cropland: develop techniques to make manure a useful and widely used fertilizer and reduce synthetic fertilizer application in the study area by as much as 75%; drastically reduce the use of manure in the study area; or significantly increase the agricultural output (harvest) without increasing the nitrogen input. Nitrate source reduction efforts will involve a combination of these options (see Section 2.3).

The following sections further discuss individual inputs and outputs that control agricultural cropland nitrate leaching.

Cropland inputs: Synthetic fertilizer (204 Gg N/yr [225,000 t N/yr]). Synthetic fertilizer application rates are estimated by first establishing a typical nitrogen application rate for each crop, derived from the literature, United States Department of Agriculture (USDA) Chemical Usage Reports,

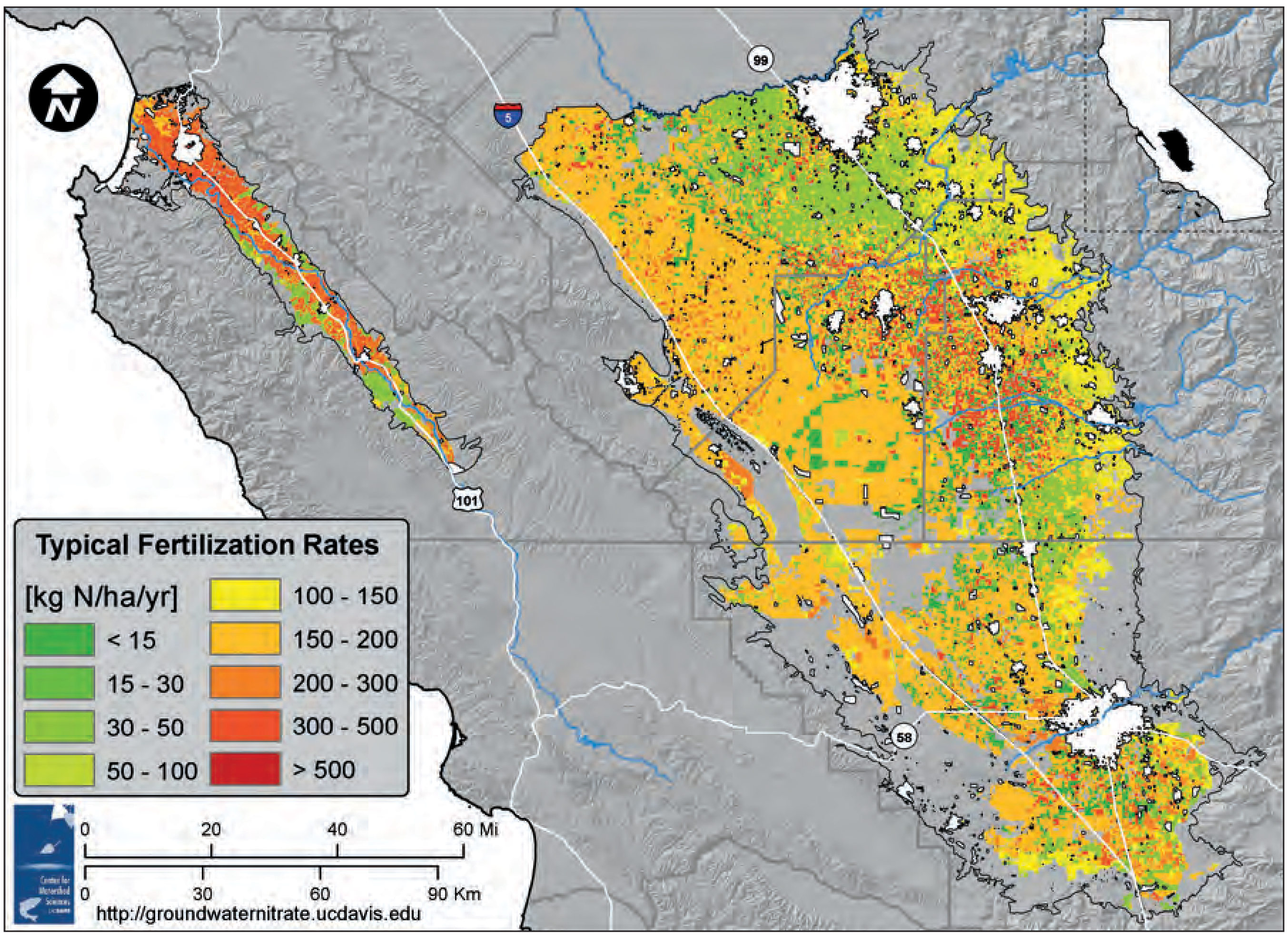


Figure 4. Current typical annual fertilization rates (1 kg/ha/yr = 1.1 lb/ac/yr) in irrigated agricultural cropland of the study area derived from the literature, USDA Chemical Usage Reports, and agricultural cost and return studies for each of 58 crop categories (does not include excess manure applications). Rates account for multi-cropping in some vegetable crops and double-cropping of corn and winter grain. Source: Viers et al. 2012.

and UC Davis ARE agricultural cost and return studies for each of 58 crop categories within 10 crop groups (Figure 4). In a second step, we assess whether some of the typical nitrogen application rate is met by other sources such as effluent, biosolids, and manure. The procedure varies with crop type, location, and aggregation level. Fertilizer needs not met by effluent, biosolids, or manure (see below) are assumed to be met by synthetic fertilizer, providing an estimate of synthetic fertilizer use at local (Figure 4), crop (see Figure 7), county (see Table 2), and study area (see Figure 3) levels. The magnitude of total estimated synthetic fertilizer use (204 Gg N/yr [225,000 t N/yr]) in the study area, on about 40% of California's irrigated land, is consistent with statewide average recorded sales of synthetic fertilizer used on cropland of 466 Gg N/yr (514,000 t N/yr) (D. Liptzin, pers. comm., 2012).

Cropland inputs: Animal manure (land-applied: 128 Gg N/yr [141,000 t N/yr]; corral and lagoon loading directly to groundwater: 1.7 Gg N/yr [1,900 t N/yr]). The Tulare Lake Basin houses 1 million adult dairy cows and their support stock (more than half of California's dairy herd), 10,000 hogs and pigs, and 15 million poultry animals. Dairy cattle are by far the largest source of land-applied manure nitrogen in the area (127 Gg N/yr [140,000 t N/yr]; see Figure 3). Manure is collected in dry and liquid forms, recycled within the animal housing area for bedding (dry manure) and as flushwater (freestall dairies), and ultimately applied to the land. Manure is applied in solid and liquid forms, typically on forage crops (e.g., summer corn, winter grain) managed by the dairy farm, or is exported to nearby farms (mostly as manure solids) and used as soil amendment. The amount of land-applied manure nitrogen is estimated based on: recently published studies of dairy cow, swine, and poultry excretion rates; animal numbers reported by the Regional Water Board and the USDA Agricultural Census; and an estimated 38% atmospheric nitrogen loss in dairy facilities before land application of the manure. Manure not exported from dairy farms is applied to portions of 130,000 ha (320,000 ac) of dairy cropland. Exported manure nitrogen is largely applied within the study area, mostly within the county of origin, on cropland nearby dairies.

Direct leaching to groundwater from animal corrals and manure lagoons is about 1.5 Gg N/yr (1,700 t N/yr) and 0.2 Gg N/yr (220 t N/yr), respectively (see Table 1).

Cropland inputs: Irrigation water (29 Gg N/yr [32,000 t N/yr]). Irrigation water is also a source of nitrogen applied to crops. Surface irrigation water is generally very low in nitrate. Nitrate in groundwater used as irrigation water is a significant source of nitrogen but varies widely with location and time. We used average nitrate concentrations measured in wells and basin-wide estimates of agricultural groundwater pumping (Faunt 2009) to estimate the total nitrogen application to agricultural lands from irrigation water, in the range of 20 Gg N/yr (22,000 t N/yr) to 33.4 Gg N/yr (36,800 t N/yr).

Cropland and general landscape inputs: Aerial deposition (12 Gg N/yr [13,000 t N/yr]). Nitrogen emissions to the atmosphere as NOx from fossil fuel combustion and ammonia from manure at confined animal feeding operations undergo transformations in the atmosphere before being redeposited, often far from the source of emissions. Nitrogen deposition estimates at broader spatial scales are typically based on modeled data. Nitrogen deposition in urban and natural areas was assumed to be retained with the ecosystem (Vitousek and Howarth 1991). In cropland, nitrogen deposition was included in the nitrogen mass balance. For the Salinas Valley, average aerial deposition is 5.6 kg N/ha/yr (0.6 Gg N/yr) (5.0 lb N/ac [660 t N/yr]). The Tulare Lake Basin receives among the highest levels in the state, averaging 9.8 kg N/ha/yr (11.3 Gg N/yr) (8.7 lb N/ac/yr [12,500 t N/yr]).

Cropland output: Harvested nitrogen (130 Gg N/yr [143,000 t N/yr]). The nitrogen harvested is the largest independently estimated nitrogen output flow from cropland. Historical and current annual County Agricultural Commissioner reports provide annual harvested acreage and yields for major crops. From the reported harvest, we estimate the nitrogen removed. For each of 58 crop categories, the study area total harvest nitrogen and total acreage used to estimate the rate of nitrogen harvested (Figure 5). All crops combined (not including alfalfa) contain a total of 130 Gg N/yr (143,000 t N/yr), with cotton (21 Gg N/yr [23,000 t N/yr]), field crops (28 Gg N/yr [31,000 t N/yr]), grain and hay crops (30 Gg N/yr [33,000 t N/yr]), and vegetable crops (30 Gg N/yr [30,000 t N/yr]) making up 85% of harvested nitrogen. Tree fruits, nuts, grapes, and subtropical crops constitute the remainder of the nitrogen export from cropland.

Historical Development of Fertilizer Use, Manure Production, Harvested Nitrogen, and Estimated Nitrate Leaching to Groundwater. Current and near-future groundwater nitrate conditions are mostly the result of past agricultural practices. So the historical development of nitrogen fluxes to and from cropland provides significant insight in the relationship between past agricultural practices, their estimated groundwater impacts, and current as well as anticipated groundwater quality. Two major inventions effectively doubled the farmland in production from the 1940s to the 1960s: the introduction of the turbine pump in the 1930s, allowing access to groundwater for irrigation in a region with very limited surface water supplies, and the invention and commercialization of the Haber-Bosch process, which made synthetic fertilizer widely and cheaply available by the 1940s.

The amount of cropland (not including alfalfa) in the study area nearly doubled in less than 20 years, from 0.6 million ha (1.5 million ac) in the mid-1940s to nearly 1.0 million ha (2.5 million ac) in 1960 (not including alfalfa) (Figure 6). Further increases occurred until the 1970s, to 1.3 million ha (3.2 million ac), but the extent of farmland has been relatively stable for the past 30 years.

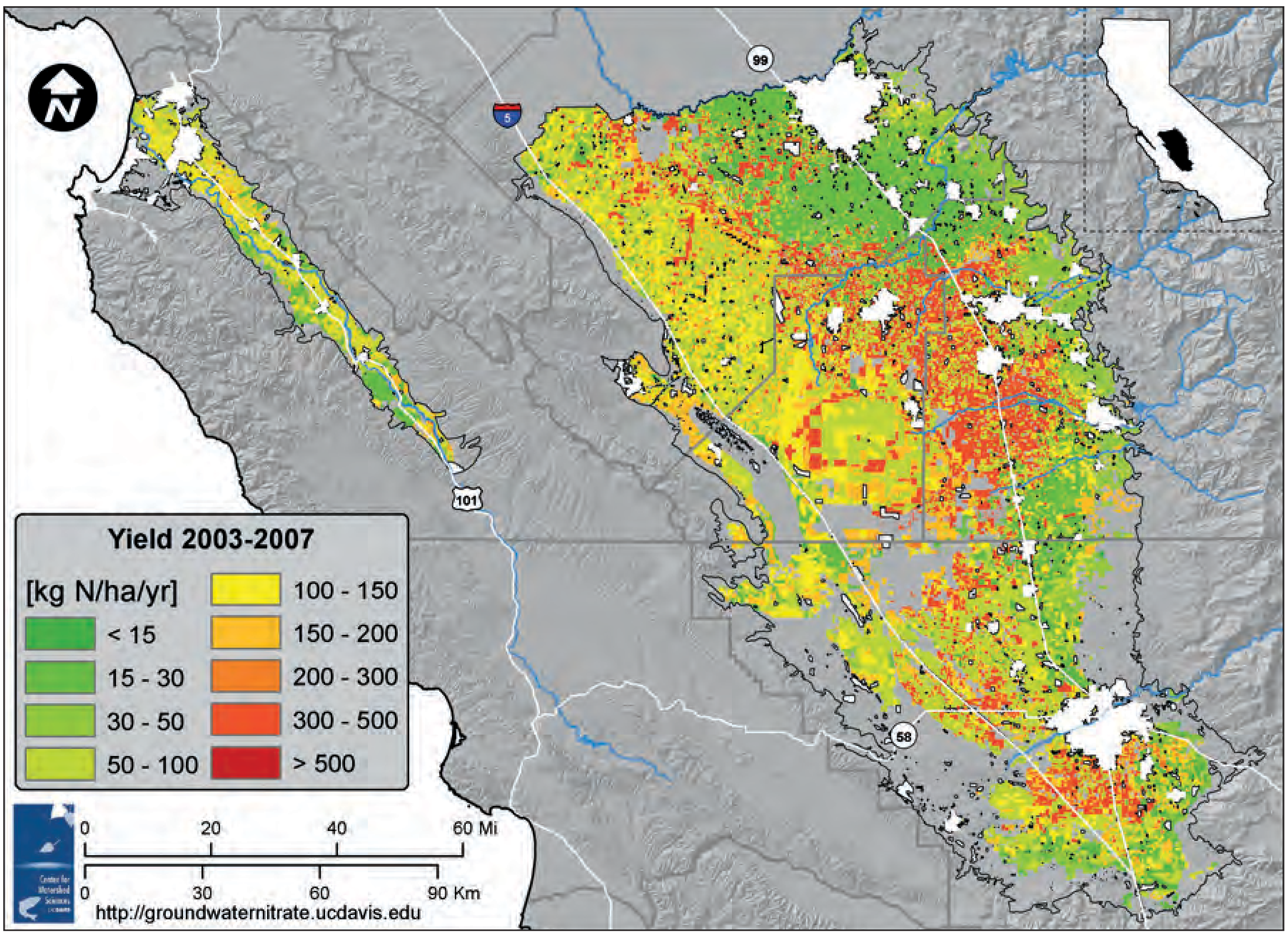


Figure 5. Current annual nitrogen removal rate in harvested materials (1 kg/ha/yr = 1.1 lb/ac/yr) derived from county reports of harvested area and harvested tonnage for each of 58 crop categories. Rates account for multi-cropping in some vegetable crops and double-cropping of corn and winter grain. Source: Viers et al. 2012.

In contrast, the harvested nitrogen has consistently increased throughout the past 60 years (see Figure 6). From 1945 to 1975, total harvested nitrogen increased twice as fast as farmland expansion, quadrupling from 20 Gg N/yr (22,000 t N/yr) to 80 Gg N/yr (88,000 t N/yr). Without further increases in farmland, harvests and harvested nitrogen increased by more than 60% in the second 30-year period, from the mid-1970s to the mid-2000s.

Synthetic fertilizer inputs also increased from the 1940s to the 1980s but have since leveled off. Between 1990 and 2005, the gap between synthetic nitrogen fertilizer applied and harvested nitrogen has significantly decreased.[4]

In contrast, dairy manure applied to land has increased exponentially, effectively doubling every 15 years (see Figure 6), from 8 Gg N/yr (9,000 t N/yr) in 1945 to 16 Gg N/yr (18,000 t N/yr) in 1960, 32 Gg N/yr (35,000 t N/yr) in 1975, 56 Gg N/yr (62,000 t N/yr) in 1990, and 127 Gg N/yr (140,000 t N/yr) in 2005, an overall 16-fold increase in manure nitrogen output. The increase in manure nitrogen is a result of increasing herd size (7-fold) and increasing milk production per cow (3-fold) and is slowed only by the increased nitrogen-use efficiency of milk production.

Until the 1960s, most dairy animals in the region were only partly confined, often grazing on irrigated pasture with

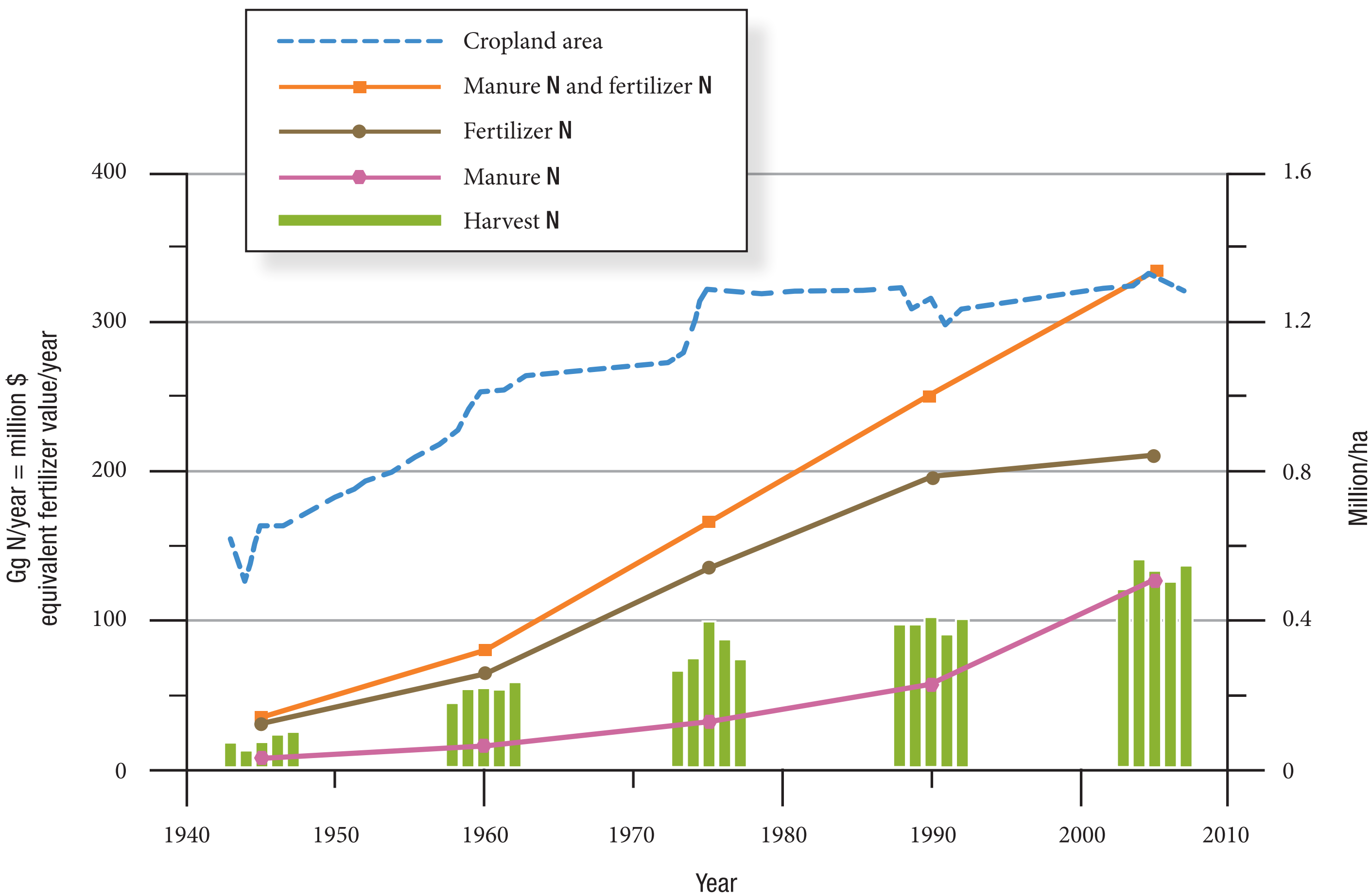


Figure 6. Estimated historical agricultural development in the study area (not including alfalfa): total harvested area, total harvested nitrogen in fertilized crops, fertilizer applied to cropland (5-year average), manure applied to cropland (5-year average), and sum of manure and fertilizer applied to cropland (5-year average). Not shown: In the study area, harvested alfalfa area grew from 0.12 million ha (0.3 million ac) in the 1940s to 0.2 million ha (0.5 million ac) around 1960, then leveled off to current levels of 0.17 million ha (0.42 million ac). Since the 1960s, nitrogen removal in alfalfa harvest has varied from 50 to 80 Gg N/yr. Note: 0.4 million ha = 1 million ac. Source: Viers et al. 2012.

[4] Fertilizer application rates and statewide fertilizer sales have grown little since the late 1980s.

limited feed imports. Manure from dairy livestock generally matched the nitrogen needs of dairy pastures. Since the 1970s, dairies in the Tulare Lake Basin have operated mostly as confined animal facilities, growing alfalfa, corn, and grain feed on-site, importing additional feed, and housing the animals in corrals and freestalls. The growth in the dairy industry has created a nitrogen excess pool that remains unabsorbed by crops (see Figure 6). Much of the nitrogen excess is a recent phenomenon (see Figure 6). With groundwater quality impacts delayed by decades in many production wells (see Section 3), the recent increase in land applied manure nitrogen is only now beginning to affect water quality in wells of the Tulare Lake Basin, with much of the impact yet to come.

Groundwater loading from irrigated agriculture, by crop group and by county. Significant differences exist in groundwater loading intensity between crop groups.[5] The intensity of groundwater loading is least in vineyards (less than 35 kg N/ha/yr [31 lb N/ac/yr]), followed by rice and subtropical tree crops (about 60 kg N/ha/yr [54 lb N/ac/yr]), tree fruits, nuts, and cotton (90–100 kg N/ha/yr [80–90 lb N/ac/yr]), vegetables and berry crops (over 150 kg N/ha/yr [130 lb N/ac/yr]), which includes some vegetables being cropped twice per year), field crops (about 480 kg N/ha/yr [430 lb N/ac/yr]), and grain and hay crops (about 200 kg N/ha/yr [180 lb N/ac/yr]). Manure applications constitute the source of nearly all of the nitrate leaching from these latter two crops. Without manure, field crops leach less than 35 kg N/ha/yr (31 lb N/ac/yr), and grain and hay crops leach 50 kg N/ha/yr (45 lb N/ac/yr). Figure 7 shows the rate of reduction (in kg N/ha/crop) that would be needed, on average across each crop group, to reduce groundwater nitrate leaching to benchmark levels.

At the county level, we aggregate cropland area, fertilizer applications (by crop category), manure output from individual dairies, effluent and biosolid land applications from individual facilities, and crop category–specific harvest. Differences in cropping patterns between counties and the absence or presence of dairy facilities within counties drive county-by-county differences in total groundwater loading and in the average intensity of groundwater loading (Table 2). Fresno County, which has fewer mature dairy cows (133,000) than Kings (180,000), Tulare (546,000), or Kern (164,000) Counties and also has large areas of vineyards (see Figure 2), has the lowest average groundwater loading intensity (103 kg N/ha/yr [103 lb N/ac/yr]). Monterey County is dominated by vegetable and berry crops (high intensity) and grape vineyards (low intensity).

Urban and Domestic Sources

Urban and domestic sources: Overview. Urban nitrate loading to groundwater is divided into four categories: nitrate leaching from turf, nitrate from leaky sewer systems, groundwater nitrate contributions from WWTPs and FPs, and groundwater nitrate from septic systems. For all these systems, groundwater nitrate loading is estimated based on either actual data or reported data of typical nitrate leaching.

Urban and domestic sources: Wastewater treatment plants and food processors (11.4 Gg N/yr [12,600 t/yr]: 3.2 Gg N/yr [3,500 t/yr] to percolation ponds, 3.4 Gg N/yr [3,800 t/yr] in effluent applications to cropland, and 4.8 Gg N/yr [5,300 t/yr] in WWTP biosolids applications to cropland). The study area has roughly 2 million people on sewer systems that collect and treat raw sewage in WWTPs. In addition, many of the 132 food processors within the study area generate organic waste that is rich in nitrogen (Table 3). Potential sources of groundwater nitrate contamination from these facilities include effluent that is land applied on cropland or recharged directly to groundwater via percolation basins, along with waste solids and biosolids that are land applied. Typically, WWTP influent contains from 20 mg N/L to 100 mg N/L total dissolved nitrogen (organic N, ammonium N, nitrate-N), of which little is removed in standard treatment (some WWTPs add treatment beyond

[5] Aggregated estimates were obtained from study area-wide totals for harvested area (by crop group), for typical nitrogen application, and for harvested nitrogen. The following averages were assumed: irrigation water nitrogen (24 kg N/ha/yr [21 lb N/ac/yr]), atmospheric nitrogen losses (10% of all N inputs), and runoff (14 kg N/ha/yr [12.5 lb N/ac/yr]). Most manure is likely land-applied to field crops, particularly corn, and to grain and hay crops. Little is known about the actual distribution prior to 2007 and the amount of synthetic fertilizer applied on fields receiving manure. As an illustrative scenario, we assume that two-thirds of dairy manure is applied to field crops and one-third of dairy manure is applied to grain and hay crops. In field crops, 50% of crop nitrogen requirements are assumed to be met with synthetic fertilizer, and in grain and hay crops 90% of their crop nitrogen requirements are assumed to be met by synthetic fertilizer. These are simplifying assumptions that neglect the nonuniform distribution of manure on field and grain crops between on-dairy, near-dairy, and away-from-dairy regions. However, corn constitutes most (106,000 ha [262,000 ac]) of the 130,000 ha (321,000 ac) in field crops, with at least 40,000 ha (99,000 ac) grown directly on dairies. Grain crops are harvested from 220,000 ha (544,000 ac). For further detail, see Viers et al. 2012.

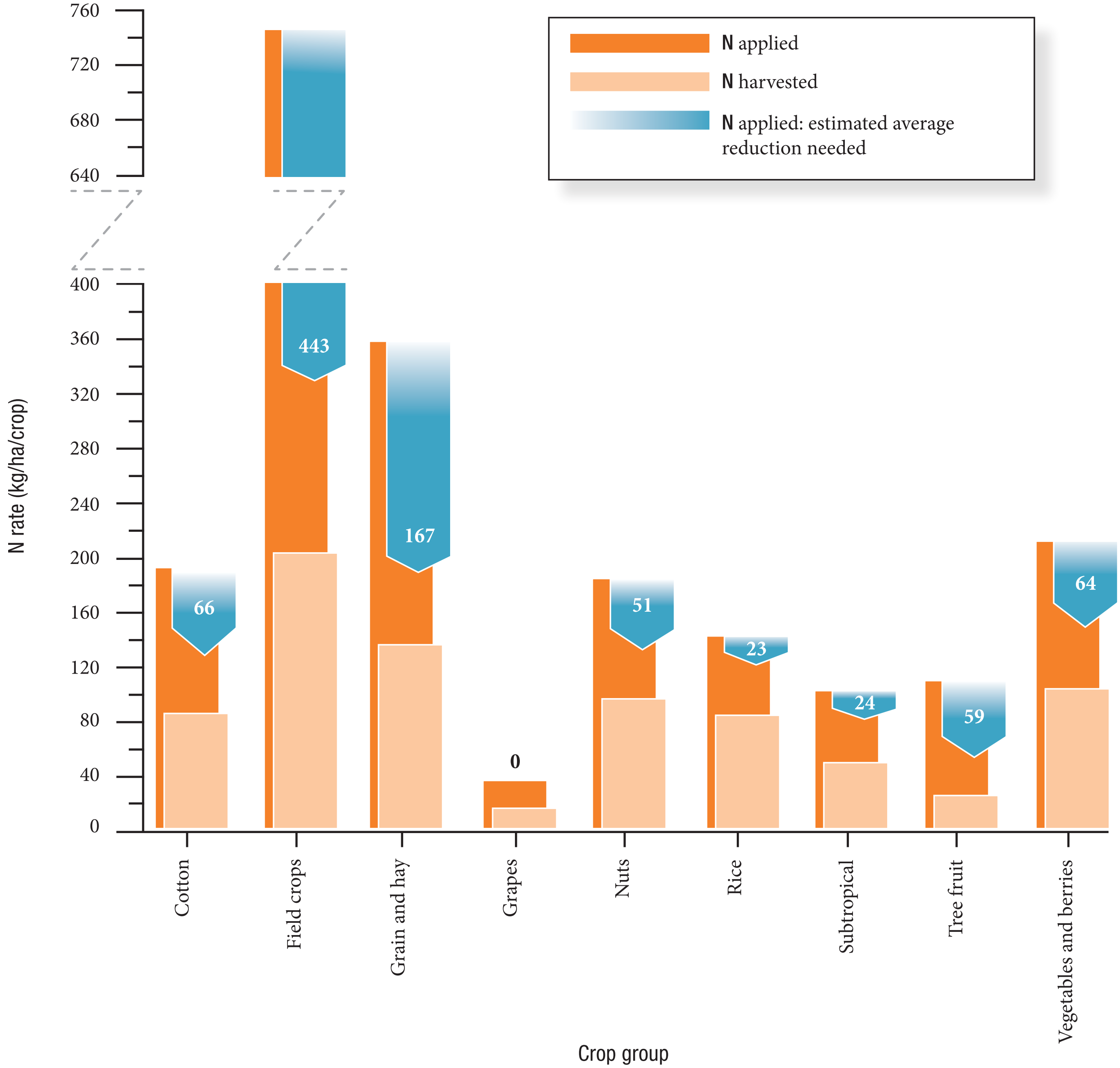


Figure 7. Nitrogen application reduction needed to reduce groundwater nitrate loading to less than 35 kg N/ha/crop, compared with average nitrogen applied (synthetic fertilizer and manure) and nitrogen harvested (all units in kg N/ha/crop). Rates are given per crop, and the required reduction does not account for double-cropping. Some vegetables and some field crops are harvested more than once per year. In that case, additional reductions in fertilizer applications would be necessary to reduce nitrate loading to less than 35 kg N/ha. Large reductions needed in field crops and grain and hay crops are due to the operational assumption that manure generated in the study area is applied to only these crop groups. Typical amounts of synthetic fertilizer applied ("N applied") to these crops, without excess manure, are 220 kg N/ha/crop for field crops and 190 kg N/ha/crop for grain and hay crops. Thus, without excess manure, average field crops and grain and hay crops may require relatively small reductions in nitrogen application. Source: Viers et al. 2012.

Table 2. Major nitrogen fluxes to and from cropland in the study area, by county (not including alfalfa)

	Synthetic Fertilizer Application Gg N/yr [1,000 t N/yr]	Manure Application Gg N/yr [1,000 t N/yr]	Land Applied Effluent and Biosolids, Gg N/yr [1,000 t N/yr]	Harvest Gg N/yr [1,000 t N/yr]	PNB* %	PNB_0† %	Groundwater Loading Gg N/yr [1,000 t N/yr]	Groundwater Loading Intensity kg N/ha/yr [lb N/ac/yr]
By County								
Fresno	62.1 [68.3]	16.6 [18.3]	0.8 [0.88]	35.5 [39.1]	44.7	54.4	42.4 [46.7]	103 [92]
Kern	50.3 [55.4]	20.4 [22.5]	4.6 [5.0]	29.6 [32.6]	39.3	56.4	42.8 [47.2]	141 [123]
Kings	27.5 [30.3]	22.0 [24.3]	1.9 [2.1]	19.6 [21.6]	38.1	62.7	29.2 [32.2]	179 [160]
Tulare	36.0 [39.7]	67.3 [74.2]	0.7 [0.77]	32.7 [36.0]	31.4	72.5	65.1 [71.8]	236 [210]
Monterey	28.1 [30.9]	1.4 [1.54]	0.1 [0.11]	12.4 [13.6]	41.9	43.5	15.6 [17.2]	138 [123]
By Basin								
TLB	176 [194]	127 [140]	8.1 [8.9]	118 [130]	37.8	60.5	179 [197]	155 [138]
SV	28 [30.8]	1 [1.1]	0.1 [0.11]	12 [13]	41.9	43.5	16 [18]	138 [123]
Overall	**204 [225]**	**128 [141]**	**8.2 [9]**	**130 [143]**	**38.2**	**58.3**	**195 [215]**	**154 [137]**

Source: Viers et al. 2012.

Manure applications include non-dairy manure nitrogen (0.9 Gg N/yr [(990 t N/yr)] for the entire study area). Groundwater loading accounts for atmospheric deposition (9.8 and 5.6 kg N/ha/yr [(8.7 and 5 t N/yr)] in TLB and SV, respectively), atmospheric losses (10% of all inputs), irrigation water quality (22.8 kg N/ha/yr [20 lb N/ac/yr]), and runoff (14 kg N/ha/yr [12.5 lb N/ac/yr]) to and from agricultural cropland, in addition to fertilizer and manure application, and harvested nitrogen. Synthetic fertilizer application on field crops is assumed to meet 50% of typical application rates; on grain and hay crops, 90% of typical applications, with the remainder met by manure.

* PNB = partial nutrient balance, here defined as Harvest N divided by (Synthetic + Manure + Effluent + Biosolids Fertilizer N).

† PNB_0 = hypothetical PNB, if no manure/effluent/biosolids overage was applied above typical fertilizer rates.

conventional processes to remove nutrients including nitrate and other forms of nitrogen). Across the study area, WWTP effluent nitrogen levels average 16 mg N/L. Within the study area, 40 WWTPs treat 90% of the urban sewage. FP effluent nitrogen levels to percolation basins and irrigated agriculture average 42 mg N/L and 69 mg N/L, respectively.

Urban and domestic sources: Septic systems (2.3 Gg N/yr [2,500 t N/yr]). Crites and Tchobanoglous (1998) estimated that the daily nitrogen excretion per adult is 13.3 g. Approximately 15% of that nitrogen is assumed to either stay in the septic tank, volatilize from the tank, or volatilize from the septic leachfield (Siegrist et al. 2000). Based on census data, the number of people on septic systems in the study areas is about 509,000 for the Tulare Lake Basin and 48,300 for Salinas Valley. Total nitrate loading from septic leaching is 2.1 Gg N/yr (2,300 t N/yr) in the Tulare Lake Basin and 0.2 Gg N/yr (220 t N/yr) in the Salinas Valley. The distribution of septic systems varies greatly. The highest density of septic systems is

Table 3. Total nitrogen discharge to land application and average total nitrogen concentration (as nitrate-N, MCL: 10 mg N/L) in discharge to percolation basins from WWTPs and FPs, based on our surveys of WWTPs and the FP survey of Rubin et al. (2007)

	Biosolids Gg N/yr [1,000 t N/yr]	WWTP Land Application Gg N/yr [1,000 t N/yr]	WWTP Percolation Concentration mg N/L	FP Land Application Gg N/yr [1,000 t N/yr]	FP Percolation Concentration mg N/L
By County					
Fresno	0.006 [0.006]	0.40 [0.40]	18.5	0.42 [0.46]	56.2
Kern	3.1 [3.4]	0.92 [0.92]	17.7	0.56 [0.62]	43.9
Kings	1.6 [1.7]	0.09 [0.09]	11.2	0.26 [0.29]	2.1
Tulare	0.038 [0.044]	0.50 [0.50]	14.9	0.13 [0.14]	34.2
Monterey	0 [0]	0.09 [0.09]	13.9	0.05 [0.05]	22.1
By Basin					
Tulare Lake Basin	4.8 [5.3]	1.9 [2.1]	16.3	1.37 [1.51]	43.3
Salinas Valley	0 [0]	0.09 [0.09]	13.9	0.05 [0.05]	22.1
Overall	**4.8 [5.3]**	**2.0 [2.2]**	**16**	**1.4 [1.5]**	**42**

in peri-urban (rural sub-urban) areas near cities but outside the service areas of the wastewater systems that serve those cities (Figure 8). In the Tulare Lake Basin and Salinas Valley, 7.9% and 12.6%, respectively, of the land area exceeds the EPA-recommended threshold of 40 septic systems per square mile (0.154 systems per ha). Nearly 1.5% of the study area has a septic system density of over 256 systems per square mile (1 system/ha, or 1 system/2.5 ac). In those areas, groundwater leaching can significantly exceed our operational benchmark rate of 35 kg N/ha/yr (31 lb N/ac/yr).

Urban and domestic sources: Fertilizer and leaky sewer lines (0.88 Gg N/yr [970 t N/yr]). Fertilizer is used in urban areas for lawns, parks, and recreational facilities such as sports fields and golf courses. These land uses differ in their recommended fertilizer use, and there is almost no evidence of actual fertilization rates. Based on the most comprehensive survey of turfgrass leaching, only about 2% of applied nitrogen fertilizer was found to leach below the rooting zone (Petrovic 1990). For our nitrogen flow calculations, we assume a net groundwater loss of 10 kg N/ha/yr (8.9 lb N/ac/yr) from lawns and golf courses in urban areas (0.35 Gg N/yr [380 t N/yr]).

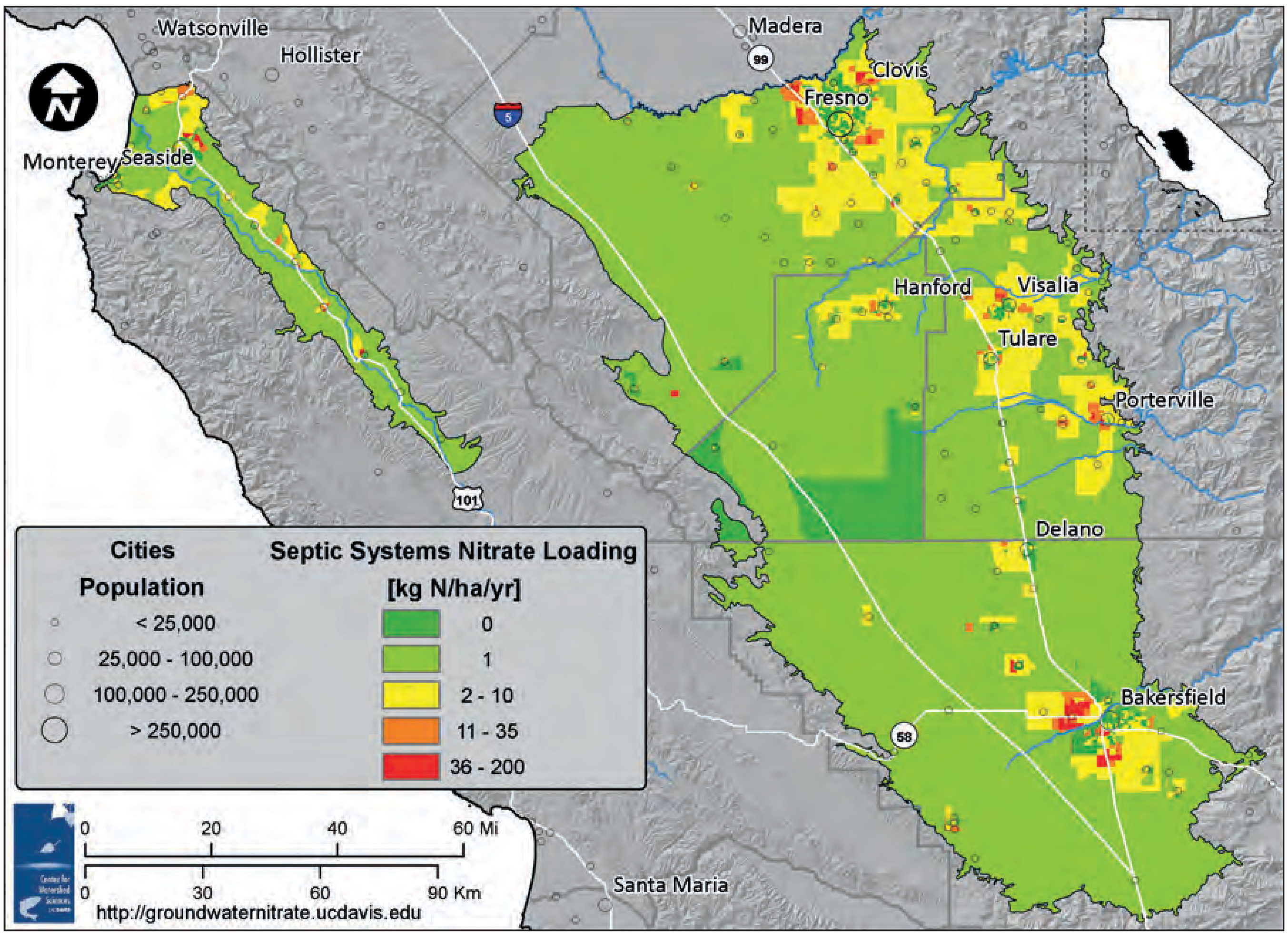


Figure 8. Septic-derived nitrate leaching rates within the study area. Source: Viers et al. 2012.

Sewer systems in urban areas can be a locally significant source of nitrogen. We use both reported sewer nitrogen flows and per capita nitrogen excretion rates to obtain total nitrogen losses via leaky sewer lines in urban areas. Nationally, estimated municipal sewer system leakage rates range from 1% to 25% of the total sewage generated. Given that much of the urban area within the study region is relatively young, we consider that the leakage rate is low, roughly 5% or less (0.53 Gg N/yr).

General Sources

General sources: Wells, dry wells, and abandoned wells (<0.4 Gg N/yr [<440 t N/yr]). Wells contribute to groundwater nitrate pollution through several potential pathways. Lack of or poor construction of the seal between the well casing and the borehole wall can lead to rapid transport of nitrate-laden irrigation water from the surface into the aquifer. In an inactive or abandoned production well, long well screens (several hundred feet) extending from relatively shallow depth to greater depth, traversing multiple aquifers, may cause water from nitrate-contaminated shallow aquifer layers to pollute deeper aquifer layers, at least in the vicinity of wells. Dry wells, which are large-diameter gravel-filled open wells, were historically designed to capture stormwater runoff or irrigation tailwater for rapid recharge to groundwater. Abandoned wells also allow surface water leakage to groundwater (spills) and cross-aquifer contamination. Lack of backflow prevention devices can lead to direct introduction of fertilizer chemicals into the aquifer via a supply well. Few data are available on these types of nitrate transfer in the Tulare Lake Basin or Salinas Valley. In a worst-case situation, as much as 0.4 Gg N/yr (440 t N/yr) may leak from the surface to groundwater via improperly constructed, abandoned, or dry wells, and as much as 6.7 Gg N/yr (7,400 t N/yr) are transferred within wells from shallow to deeper aquifers. Actual leakage rates are likely much lower than these worst-case estimates.

Groundwater Nitrate Loading: Uncertainty. The analyses above provide specific numbers for the average amount and intensity of nitrate loading from various categories of sources. However, discharges of nitrate to groundwater may vary widely between individual fields, farms, or facilities of the same category due to differences in operations, management practices, and environmental conditions. Also, average annual nitrate loading estimates for specific categories are based on many assumptions and are based on (limited) data with varying degrees of accuracy; the numbers given represent a best, albeit rough, approximation of the actual nitrate loading from specific sources. These estimates have inherent uncertainty. Very likely, though, the actual groundwater nitrate loading from source categories falls within the ranges shown in Table 1.

2.3 Reducing Nitrate Source Emissions to Groundwater

Although reduction of anthropogenic loading of nitrate to groundwater aquifers will not reduce well contamination in the short term (due to long travel times), reduction efforts are essential for any long-term improvement of drinking water sources. Technologies for reducing nitrate contributions to groundwater involve (a) reducing nitrogen quantity discharged or applied to the land and (b) controlling the quantity of water applied to land, which carries nitrate to groundwater (Dzurella et al. 2012).

Many source control methods require changes in land management practices and upgrading of infrastructure. Costs for mitigation or abatement vary widely and can be difficult to estimate. In particular, the quantity of nitrate leached from irrigated fields (the largest source) is determined by a complex interaction of nitrogen cycle processes, soil properties, and farm management decisions. Only broad estimates of the cost of mitigation per unit of decrease in the nitrate load are possible.

Reducing Nitrate Loading from Irrigated Cropland and Livestock Operations

Reduction of nitrate leaching from cropland, livestock, and poultry operations can come from changes in farm management that improve crop nitrogen use efficiency and proper storage and handling of manure and fertilizer. A common measure of cropland nitrogen use efficiency is the partial nitrogen balance (PNB), which is the ratio of harvested nitrogen to applied (synthetic, manure, or other organic) fertilizer nitrogen (Table 2).

We reviewed technical and scientific literature to compile a list of practices known or theorized to improve crop nitrogen use efficiency. Crop-specific expert panels reviewed and revised this list of practices. Input from these panel members also helped to estimate the current extent of use of each practice in the study area and to identify barriers to expanded adoption.

PNB can be increased by optimizing the timing and application rates of fertilizer nitrogen, animal manure, and irrigation water to better match crop needs, and to a lesser extent by modifying crop rotation. Improving the storage and handling of manure, livestock facility wastewater, and fertilizer also helps reduce nitrate leaching. A suite of improved management practices is generally required to reduce nitrate leachate most effectively, and these must be chosen locally for each unique field situation. No single set of management practices will be effective in protecting groundwater quality everywhere. The best approach depends on the crop grown, soil characteristics of the field, and other specific factors. As summarized in Table 4, ten key farm management measures for increasing crop nitrogen use efficiency (and PNB) are identified and reviewed (Dzurella et al. 2012).

Although PNBs as low as 33% have been reported, a recent EPA report estimated that with the adoption of best management practices, PNB could increase by up to 25% of current average values (U.S. EPA 2011). Improvements in PNB are possible, but a practical upper limit is about 80% crop recovery of applied nitrogen (U.S. EPA 2011; Raun and Schepers 2008). This limit is due to the unpredictability of rainfall, the difficulty in predicting the rate of mineralization of organic nitrogen in the soil, spatial variability and nonuniformity in soil properties, and the need to leach salts from the soil.

Table 4. Management measures for improving nitrogen use efficiency and decreasing nitrate leaching from agriculture (local conditions determine which specific practices will be most effective and appropriate)

Basic Principle	Management Measure	Number of Recommended Practices
Design and operate irrigation and drainage systems to decrease deep percolation.	MM 1. Perform irrigation system evaluation and monitoring.	3
	MM 2. Improve irrigation scheduling.	4
	MM 3. Improve surface gravity system design and operation.	6
	MM 4. Improve sprinkler system design and operation.	5
	MM 5. Improve microirrigation system design and operation.	2
	MM 6. Make other irrigation infrastructure improvements.	2
Manage crop plants to capture more N and decrease deep percolation.	MM 7. Modify crop rotation.	4
Manage N fertilizer and manure to increase crop N use efficiency.	MM 8. Improve rate, timing, placement of N fertilizers.	9
	MM 9. Improve rate, timing, placement of animal manure applications.	6
Improve storage and handling of fertilizer materials and manure to decrease off-target discharges.	MM 10. Avoid fertilizer material and manure spills during transport, storage, and application.	9
		Total: 50

Source: Dzurella et al. 2012.

Based on expert panel commentary, several farm management practices that reduce nitrate leaching have been widely adopted in recent years in the study area, representing a positive change from past practices that have contributed to current groundwater nitrate concentrations. High PNB can sometimes increase yields and decrease costs to the producer (by decreasing costs for fertilizer and water). Alas, field data that document improvements in nitrate leaching from these actions are largely unavailable.

Significant barriers to increased adoption of improved practices exist. These include higher operating or capital costs, risks to crop quality or yield, conflicting farm logistics, and constraints from land tenure. Lack of access to adequate education, extension, and outreach activities is another primary barrier, especially for the adoption of many of the currently underused practices, highlighting the importance of efforts such as those offered by the University of California Cooperative Extension. The future success of leaching reductions through improved crop and livestock facility management will require a significant investment in crop-specific research that links specific management practices with groundwater nitrate contamination. Additional investments in farmer (and farm labor) education and extension opportunities are needed, as well as increased support for farm infrastructure improvements. Monitoring and assessment programs need to be developed to evaluate management practices being implemented and their relative efficacy.

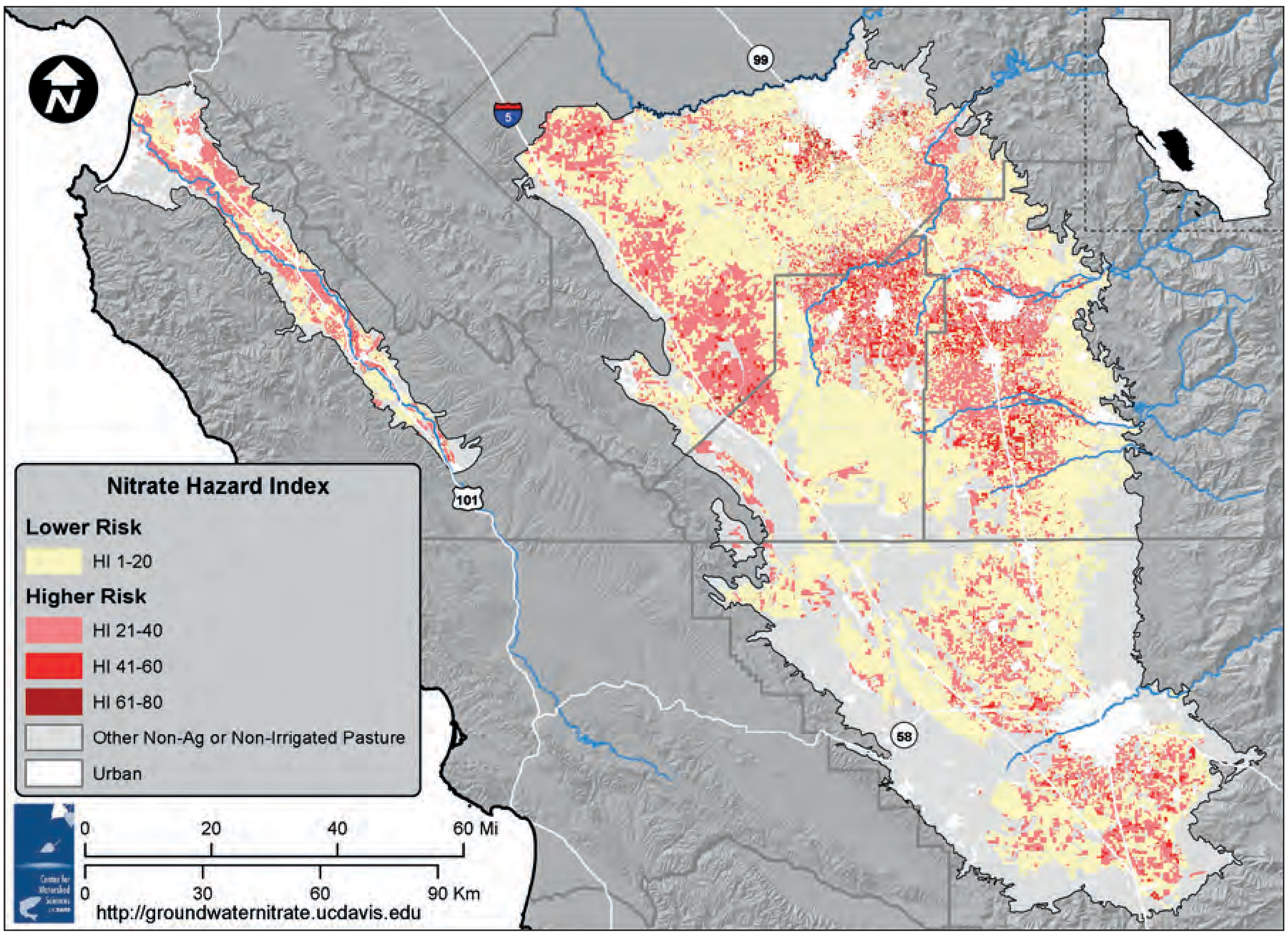


Figure 9. Overall nitrate hazard index calculated for the study area fields. Index values over 20 indicate increased potential for nitrate leaching from the crop root zone, benefiting most from implementation of improved management practices. Comparison between values in the higher-risk categories is not necessarily an indication of further risk differentiation, but it may indicate that multiple variables are involved in risk. Less-vulnerable areas still require vigilance in exercising good farm management practices. Source: Dzurella et al. 2012.

To establish the areas that would benefit most from improved management practices, we conducted a vulnerability assessment. Management-specific vulnerability was mapped using the UC Nitrate Hazard Index (Wu et al. 2005), which calculates the potential of nitrate leaching as a function of the crop grown, the irrigation system type in use, and the soil characteristics of each individual field. Based on this information, approximately 52% of irrigated cropland in the Salinas Valley and 35% of such land in the Tulare Lake Basin would most benefit from broad implementation of improved management practices (Figure 9).

A maximum net benefit modeling approach was developed to estimate relative costs of policies to improve PNB while maintaining constant crop yields for selected crop groups in the study area. Net revenue losses from limiting nitrate load to groundwater increase at an increasing rate (Table 5 and Figure 10). Our modeling results, although preliminary due to the lack of data on the cost of improving nitrogen use efficiency, suggest that reductions of 25% in total nitrate load to groundwater from crops will slightly increase production costs but are unlikely to affect total irrigated crop area, as summarized in Table 5. Smaller reductions (<10%) can be achieved at low costs, assuming adequate farmer education is in place (see Figure 10).

Greater reductions in total nitrate loading (>50%) are much more costly to implement, as capital and management investments in efficient use of nitrogen are required. Achieving such high load reductions may ultimately shift cropping toward more profitable and nitrogen-efficient crops or fallowing, as lower-value field crops and low-PNB crops lose

Table 5. Summary of how two groundwater nitrate load reduction scenarios may affect total applied water, annual net revenues, total crop area, and nitrogen applications, according to our estimative models for each basin*

Region	Scenario	Applied Water km^3/yr [million AF/yr]	Net Revenues $M/yr (2008)	Irrigated Land 1,000 ha [ac]	Applied Nitrogen Gg N/yr (%) [1,000 t/yr]
Tulare Lake Basin	base load	10.5 [8.5]	4,415 (0%)	1,293 [3,194]	200 (0%) [221]
	25% load reduction	10.0 [8.1]	4,259 (–3.5%)	1,240 [3,064]	181 (–9%) [199]
	50% load reduction	7.9 [6.4]	3,783 (–14%)	952 [2,352]	135 (–32%) [149]
Salinas Valley	base load	0.37 [0.30]	309 (0%)	92 [227]	18 (0%) [19]
	25% load reduction	0.33 [0.27]	285 (–7.5%)	83 [205]	15 (–16%) [16]
	50% load reduction	0.25 [0.20]	239 (–22%)	62 [153]	10 (–46%) [11]

Source: Dzurella et al. 2012.

* Irrigated land area and applied nitrogen in base load vary slightly from those reported in Section 2.2 due to land use data being based on Figure 2 (derived from DWR data) instead of County Agricultural Commissioner Reports (Figure 6).

favor economically. The average net revenue loss of reducing nitrate loading to groundwater is estimated to be $16 per kilogram of nitrogen at this 50% reduction level. Modeling a 7.5% sales fee on nitrogen fertilizer indicated an estimated reduction in total applied nitrogen by roughly 1.6%, with a 0.6% loss in net farm revenues.

Agricultural source reduction: Promising actions. Expanded efforts to promote nitrogen-efficient practices are needed. Educational and outreach activities could assist farmers in applying best management practices (BMPs) and nutrient management. Research should focus on demonstrating the value of practices on PNB and on adapting practices to local conditions for crop rotations and soils with the greatest risk of nitrate leaching. This especially includes row crops receiving high rates of nitrogen and/or manure that are surface- or sprinkler-irrigated. Research on the costs of increasing nitrogen use efficiency in crops would greatly benefit the capacity to estimate the economic costs of reductions in agricultural nitrate loading to groundwater. Research and education programs are needed to promote conversion of solid and liquid dairy manure into forms that meet food safety and production requirements for a wider range of crops.

We suggest that a working group develop crop-specific technical standards on nitrogen mass balance metrics for regulatory and assessment purposes. This nitrogen-driven metric would reduce the need for more expensive direct measurement of nitrate leaching to groundwater. Such

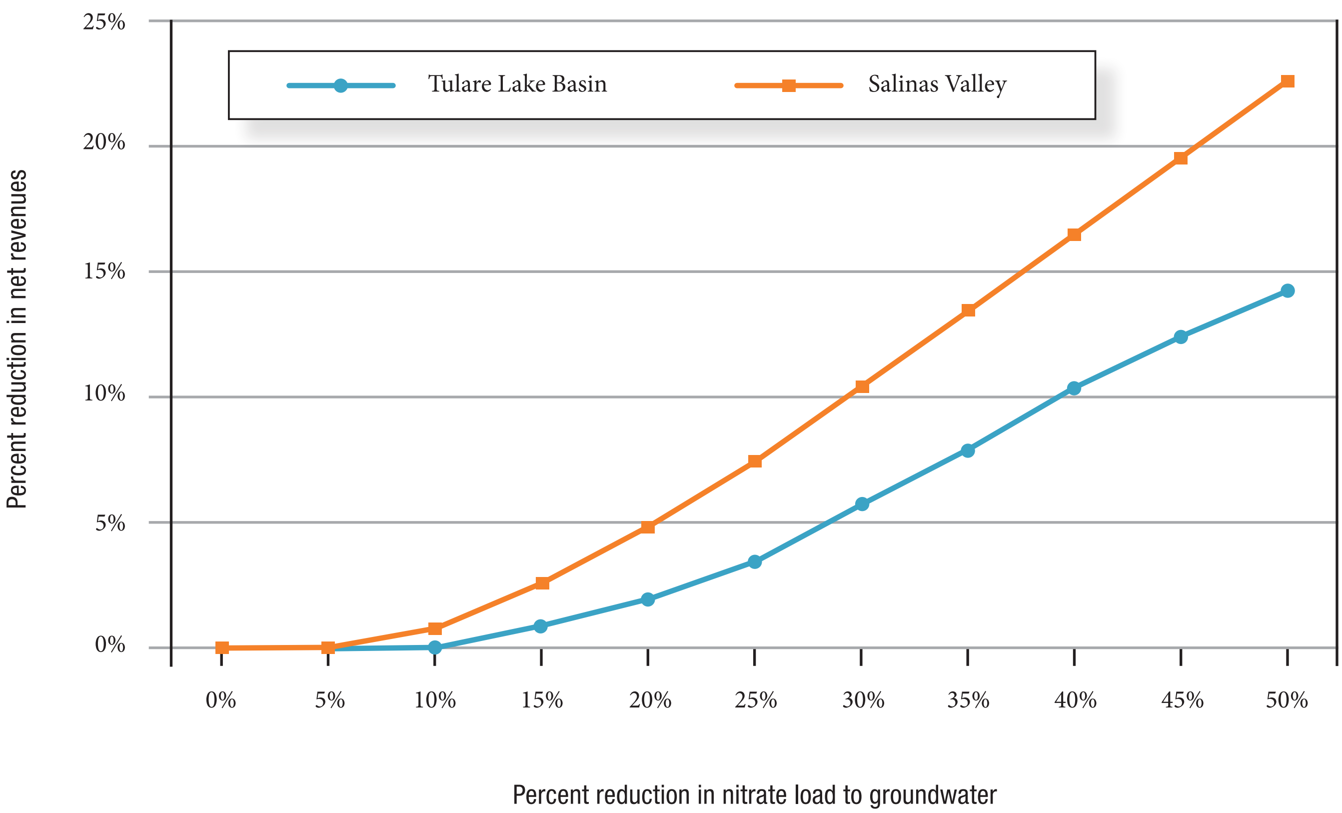


Figure 10. Percent reduction in net revenues estimated from different levels of reduction in nitrate loading to groundwater. Source: Dzurella et al. 2012.

metrics would also serve as a starting point to assist farmers in assessing their crop nitrogen use efficiency and be useful for nitrogen management. Finally, we recommend that a task force review and further develop methods to identify croplands most in need of improved management practices. Such a method should include consideration of soil characteristics (as in the UC Nitrate Hazard Index), as well as possible monitoring requirements.

Reducing Nitrate Leaching from Municipal Wastewater Treatment and Food Processing Plants

Implementation of nitrogen control options for WWTP and FP sources is feasible and useful. Nitrogen removal from wastewater can be accomplished using a variety of technologies and configurations; both biological and physical or chemical processes are effective. The selection of the most appropriate treatment option depends on many factors.

Estimated capital costs for nutrient removal from all wastewater (FPs and WWTPs) for facilities categorized as "at-risk" range from $70 to $266 million. Cropland application of wastewater treatment and food processing effluents can reduce direct groundwater contamination and total fertilizer application requirements of such fields, as the water and nutrients are effectively treated and recycled. These wastes should be managed in an agronomic manner rather than applied to land for disposal or land treatment purposes so that the nutrients are included in the overall nitrogen management plan for the receiving crops.

Optimizing wastewater treatment plant and food processing plant operations is another way to reduce nitrogen and total discharge volume. Facility process modifications may be sufficient in some cases. Groundwater monitoring is required for many facilities, but the data are largely unavailable since they are not in a digital format. To improve monitoring, enforcement, and abatement efforts related to these facilities, groundwater data need to be more centrally managed and organized digitally.

Reducing Nitrate Contributions from Leaking Sewer Pipes and Septic Systems

Retrofitting of septic system components and sewer pipes is the main way to diminish loading from these sources. Replacing aging sewer system infrastructure and ensuring proper maintenance are required to reduce risks to human health; such infrastructure upgrades also reduce nitrate leaching.

Loading from septic systems, significant locally, can be reduced significantly by two approaches where connection to a sewer system is not possible. Source separation technology can reduce nitrate loading to wastewater treatment systems by about 50%. Costs include separating toilets ($300–$1,100), dual plumbing systems ($2,000–$15,000), storage tank costs, and maintenance, pumping, heating, and transport costs (where applicable). Post-septic tank biological nitrification and denitrification treatment reduces nitrate concentrations below levels achieved via source separation technology but does not result in a reusable resource. Wood chip bioreactors have reduced influent nitrate by 74% to 91%, with costs ranging from $10,000 to $20,000 to retrofit existing septic systems.

Reducing Nitrate Leaching from Turfgrass in Urban Areas

Nitrate leaching from urban turfgrass, including golf courses, is often negligible due to the dense plant canopy and perennial growth habit of turf, which results in continuous plant nitrogen uptake over a large portion of the year. However, poor management can lead to a discontinuous canopy and weed presence, wherein nitrate leaching risk increases, especially if the turf is grown on permeable soils, is overirrigated, or is fertilized at high rates during dormant periods. The UCCE and UC IPM publish guidelines on proper fertilizer use in turfgrass. The knowledge and willingness of homeowners and groundskeepers to apply guidelines depend on funding for outreach efforts.

Reducing Nitrate Transfer and Loading from Wells

Backflow prevention devices should be required on agricultural and other wells used to mix fertilizer with water. Furthermore, local or state programs and associated funding to identify and properly destroy abandoned and dry wells are needed to prevent them from becoming nitrate transfer conduits. However, many well owners may not be able to afford the high costs of retrofitting long-screened wells to seal contaminated groundwater layers. As such, enforcement of proper well construction standards for future wells may be more feasible. Expenditures on retrofitting of existing dry and abandoned wells should be based on the contamination risks of individual wells. The nitrate contamination potential of wells needs to be identified as a basis for developing and enforcing improved, appropriate well construction standards that avoid the large-scale transfer of nitrate to deep groundwater in all newly constructed wells.

3 Impact: Groundwater Nitrate Occurrence

3.1 Current Groundwater Quality Status

We assembled groundwater quality data from nearly two dozen local, state, and federal agencies and other sources into a dataset, here referred to as the (Central) California Spatio-Temporal Information on Nitrate in Groundwater (CASTING) dataset (see Table 6 for information about data sources, Boyle et al. 2012). The dataset combines nitrate concentrations from 16,709 individual samples taken at 1,890 wells in the Salinas Valley and from 83,375 individual samples taken at 17,205 wells in the Tulare Lake Basin collected from the 1940s to 2011, a total of 100,084 samples from 19,095 wells. Almost 70% of these samples were collected from 2000 to 2010; only 15% of the samples were collected prior to 1990. Half of all wells sampled had no recorded samples prior to 2000 (Boyle et al. 2012).

Of the nearly 20,000 wells, 2,500 are frequently sampled public water supply wells (over 60,000 samples). Apart from the recently established Central Valley dairy regulatory program, which now monitors about 4,000 domestic and irrigation wells in the Tulare Lake Basin, there are no existing regular well sampling programs for domestic and other private wells.

From 2000 to 2011, the median nitrate concentration in the Tulare Lake Basin and Salinas Valley public water supply well samples was 23 mg/L and 21 mg/L,[6] respectively, and in all reported non-public well samples, 23 mg/L and 20 mg/L, respectively. In public supply wells, about one in ten raw water samples exceeds the nitrate MCL. Nitrate concentrations in wells vary widely with location and well depth. More domestic wells and unregulated small system wells have high nitrate concentrations due to their shallow depth (Table 6). Highest nitrate concentrations are found in wells of the alluvial fans in the eastern Tulare Lake Basin and in wells of unconfined to semi-confined aquifers in the northern, eastern, and central Salinas Valley (Figure 11). In the Kings, Kaweah, and Tule River groundwater sub-basins of Fresno and Kings County, and in the Eastside and Forebay sub-basins of Monterey County, one-third of domestic or irrigation wells exceed the nitrate MCL. Consistent with these findings, the maximum nitrate level, measured in any given land section (1 square mile) for which nitrate data exist between 2000 and 2009, exceeds the MCL across wide portions of these areas (Figure 12). Low nitrate concentrations tend to occur in the deeper, confined aquifer in the western and central Tulare Lake Basin (Boyle et al. 2012).

Nitrate levels have not always been this high. While no significant trend is observed in some areas with low nitrate (e.g., areas of the western TLB), USGS research indicates significant long-term increases in the higher-nitrate areas of the Tulare Lake Basin (Burow et al. 2008), which is consistent with the CASTING dataset. Average nitrate concentrations in public supply wells of the Tulare Lake Basin and Salinas Valley have increased by 2.5 mg/L (±0.9 mg/L) per decade over the past three decades. Average trends of similar magnitude are observed in private wells. As a result, the number of wells with nitrate above background levels (>9 mg/L) has steadily increased over the past half century from one-third of wells in the 1950s to nearly two-thirds of wells in the 2000s (Figure 13). Due to the large increase in the number of wells tested across agencies and programs, the overall fraction of sampled wells exceeding the MCL grew significantly in the 2000s (Boyle et al. 2012).

The increase in groundwater nitrate concentration measured in domestic wells, irrigation wells, and public supply wells lags significantly behind the actual time of nitrate discharge from the land surface. The lag is due, first, to travel time between the land surface or bottom of the root zone and the water table, which ranges from less than 1 year in areas with shallow water table (<3 m [10 ft]) to several years or even decades where the water table is deep (>20 m [70 ft]). High water recharge rates shorten travel time to a deep water table, but in irrigated areas with high irrigation efficiency and low recharge rates, the transfer to a deep water table may take many decades.

[6] Unless noted otherwise, nitrate concentration is given in mg/L as nitrate (MCL = 45 mg/L).

Once nitrate is recharged to groundwater, additional travel times to shallow domestic wells are from a few years to several decades and one to several decades and even centuries for deeper production wells.

3.2 Cleanup of Groundwater: Groundwater Remediation

Groundwater remediation is the cleanup of contaminated groundwater to levels that comply with regulatory limits. In the pump-and-treat (PAT) approach, groundwater is extracted from wells, treated on the surface, and returned to the aquifer by injection wells or surface spreading basins. In-situ treatment approaches create subsurface conditions that aid degradation of contaminants underground. In-situ remediation is not appropriate for contaminants spread over large regions or resistant to degradation. Both remediation methods typically also require removal or reduction of contamination sources and long-term groundwater monitoring.

Table 6. Data sources with the total number of samples recorded, total number of sampled wells, location of wells, type of wells, and for the last decade (2000–2010) in the Tulare Lake Basin and Salinas Valley: Number of wells measured, median nitrate concentration, and percentage of MCL exceedance for the Tulare Lake Basin and the Salinas Valley*

Data Source†	Total # of Wells	Total # of Samples	Location of Wells	Type of Wells	Years 2000–2010					
					# of Wells TLB	# of Wells SV	TLB Median mg/L nitrate	SV Median mg/L nitrate	TLB % > MCL	SV % > MCL
CDPH	2,421	62,153	throughout study area	public supply wells	1,769	327	12	8	6%	5%
CVRWB DAIRY	6,459	11,300	dairies in TLB	domestic, irrigation, and monitoring wells	6,459	—	22	—	31%	—
DPR	71	814	eastern Fresno and Tulare Counties	domestic wells	71	—	40	—	45%	—
DWR	26	44	Westlands Water District	irrigation wells	28	—	1	—	0%	—
DWR Bulletin 130	685	2,862	throughout study area	irrigation, domestic, and public supply wells	—	—	—	—	—	—
ENVMON	537	2,601	throughout study area	monitoring wells	357	180	—	27	52%	44%
EPA	2,860	4,946	throughout study area	—	—	—	—	—	—	—
Fresno County	368	369	Fresno County	domestic wells	349	—	18	—	15%	—
GAMA	141	141	Tulare County	domestic wells	141	—	38	—	43%	—
Kern County	2,893	3,825	Kern County	Irrigation, domestic wells	361	—	5	—	7%	—

Continued on next page

Groundwater remediation is difficult and expensive (NRC 1994, 2000). Groundwater remediation is done only very locally (less than 1 km^2 [<0.5 mi^2] to often less than 2 ha [<5 ac]). Cleanup of contaminants over a wide region is not feasible, and would require many decades and considerable expense. The success rate for cleanup of widespread groundwater contaminants is very disappointing (NRC 1994, 2000).

Because of the difficulty and poor success rates of plume remediation, an approach known as monitored natural attenuation (MNA) has become popular. MNA involves letting natural biochemical transformations and dispersion reduce and dilute contamination below cleanup goals, while monitoring to confirm whether MNA is adequately protecting groundwater quality. However, this approach is effective only for contaminants that transform to relatively harmless byproducts. The combination of circumstances that would favor denitrification of nitrate is generally lacking in California's alluvial aquifer systems (Fogg et al. 1998; Boyle et al. 2012), so MNA does not seem to be an effective way of remediating nitrate-contaminated groundwater in the study area.

The total estimated volume of groundwater exceeding the nitrate MCL in the Tulare Lake Basin and Salinas Valley is 39.7 km^3 (32.2 million acre-feet, AF) and 4.2 km^3 (3.4 million AF), respectively, more than the total groundwater

Table 6. *Continued*

Data Source†	Total # of Wells	Total # of Samples	Location of Wells	Type of Wells	Years 2000–2010					
					# of Wells TLB	# of Wells SV	TLB Median mg/L nitrate	SV Median mg/L nitrate	TLB % > MCL	SV % > MCL
Monterey County, Reports	239	1,018	Monterey County	monitoring, irrigation wells	—	98	—	14	—	36%
Monterey County, Geospatial	388	1,574	Monterey County	local small systems wells	—	431	—	18	—	15%
Monterey County, Scanned	452	5,674	Monterey County	local small systems wells	—	427	—	17	—	14%
NWIS	1,028	2,151	—	miscellaneous	76	4	35	0	36%	0%
Tulare County	444	444	Tulare County	domestic wells	438	—	22	—	27%	—
Westlands Water District	48	77	Westlands Water District	irrigation wells	31	—	4	—	0%	—

Source: Boyle et al. 2012.

* Median and percent MCL exceedance were computed based on the annual mean nitrate concentration at each well for which data were available.

† Data sources: CDPH: public supply well database; CVRWB Dairy: Central Valley RWB Dairy General Order; DWR Bulletin 130: data reports from the 1960–1970s, 1985; ENVMON: SWRCB Geotracker environmental monitoring wells with nitrate data (does not include data from the CVRWB dairy dataset); EPA: STORET dataset; Fresno County: Public Health Department; GAMA: SWRCB domestic well survey; Kern County: Water Agency; Monterey County, Reports: data published in reports by MCWRA; Monterey County, Geospatial: Health Department geospatial database; Monterey County, Scanned: Health Department scanned paper records; NWIS: USGS National Water Information System; Tulare County: Health and Human Services; Westlands Water District: district dataset. Some smaller datasets are not listed. Individual wells that are known to be monitored by multiple sources are here associated only with the data source reporting the first water quality record.

pumped from the project area aquifers between 2005 and 2010 (Table 7). This is a basin-scale groundwater cleanup problem. Annual costs of traditional remediation would be on the order of $13 to $30 billion (Dzurella et al. 2012; King et al. 2012). This explains why no attempt at remediation of a contaminated groundwater basin on the scale of the Tulare Lake Basin or Salinas Valley has ever been undertaken. Except for cleanup of hot-spot sites, traditional remediation for nitrate is not a promising option.

A more promising remediation approach is what we refer to as "pump-and-fertilize" (PAF) (Dzurella et al. 2012; King et al. 2012). This approach uses existing agricultural wells to remove nitrate-contaminated groundwater and "treat" the water by ensuring nitrate uptake into crops through proper nutrient management. A disadvantage of PAF is that many irrigation wells are drilled deep to maximize the pumping rate, but most high levels of nitrate contamination are seen at shallower depths. Shallower nitrate-contaminated groundwater is en route toward the deep intake screens of many of the irrigation wells (Viers et al. 2012). One option is to drill intermediate-depth irrigation wells to intercept contaminated groundwater before it penetrates farther into the deeper subsurface. The cost, energy, and management requirements of this approach would need to be carefully evaluated, as it requires the drilling and operation of many shallower wells with smaller capture zones and smaller pumping rates at each well. At a regional or sub-regional scale, it may be an innovative alternative, although decades of PAF operations would be needed together with large reductions in nitrate leachate from the surface.

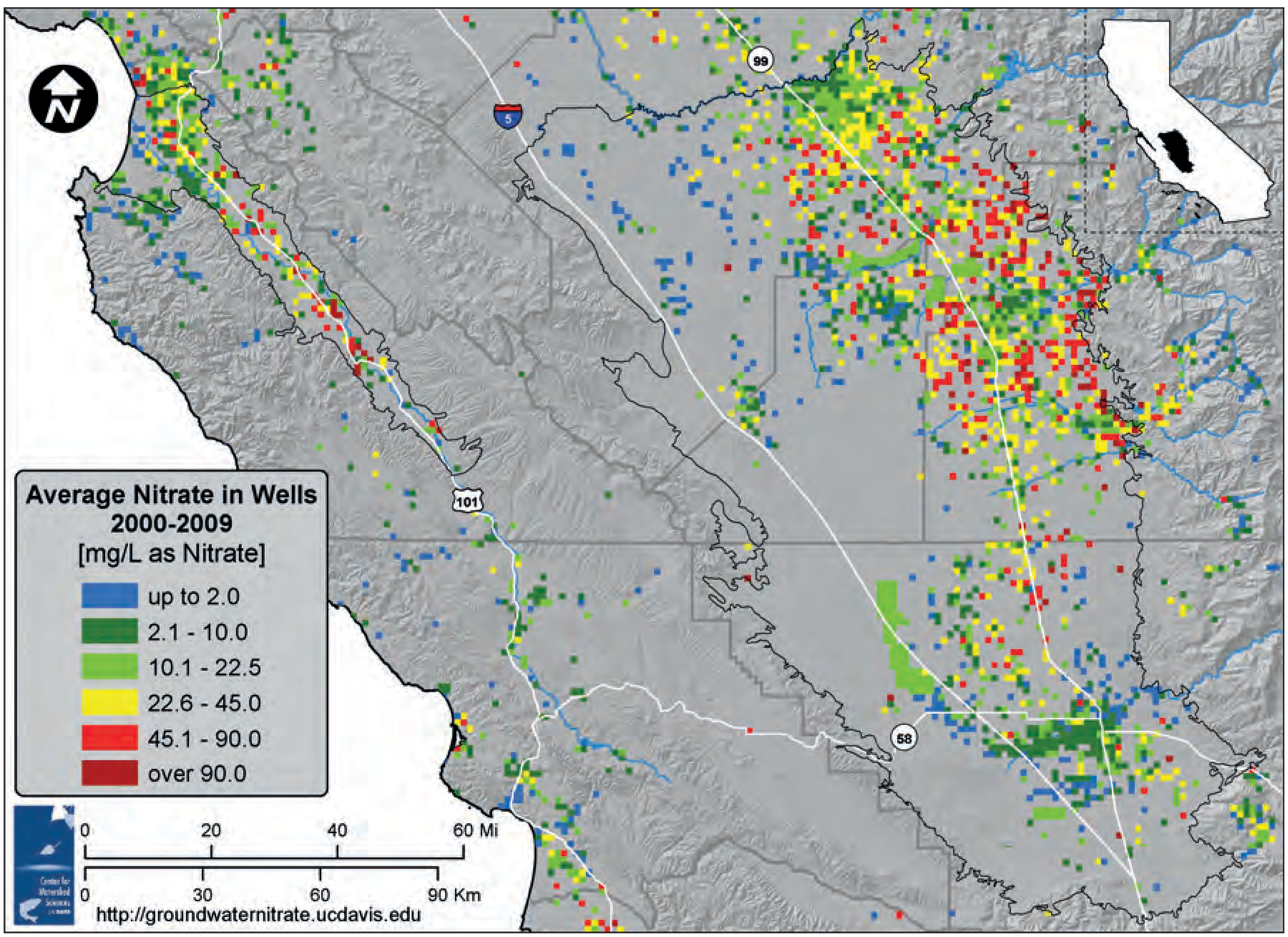


Figure 11. Mean of the time-average nitrate concentration (mg/L) in each well belonging within a square mile land section, 2000–2009. Some areas in the TLB are larger than 1 square mile. Source: Boyle et al. 2012.

Groundwater recharge operations could be managed to improve groundwater quality if the recharged water is of good quality and relatively low in nitrate (remediation by dilution). By introducing as much clean recharge water as possible, the long-term effects of contaminated agricultural recharge can be partially mitigated. But the large water volumes already affected would require decades of management.

Pump-and-fertilize along with improved groundwater recharge management are technically feasible, less costly alternatives than pump-and-treat and could help place regional groundwater quality on a more sustainable path. These alternatives should be accompanied by remediation of local nitrate contamination hot spots and long-term groundwater quality monitoring to track benefits of the strategy (for details, see King et al. 2012).

3.3 Existing Regulatory and Funding Programs for Nitrate Groundwater Contamination

Many regulatory and planning programs in the study area provide regulatory structure or technical and managerial support to water systems, communities, farmers, dairies, and others who deal with nitrate contamination in groundwater. Statutes also provide a regulatory framework for nitrate contamination of groundwater and drinking water. In the study area, there are several federal programs/statutes (Table 8a and Table 8b, blue), State programs/statutes (purple), and nongovernmental programs/agencies (orange) relevant to nitrate contamination and its effects on drinking water. Current regulatory/planning programs and statutes that have the ability to reduce groundwater nitrate contamination

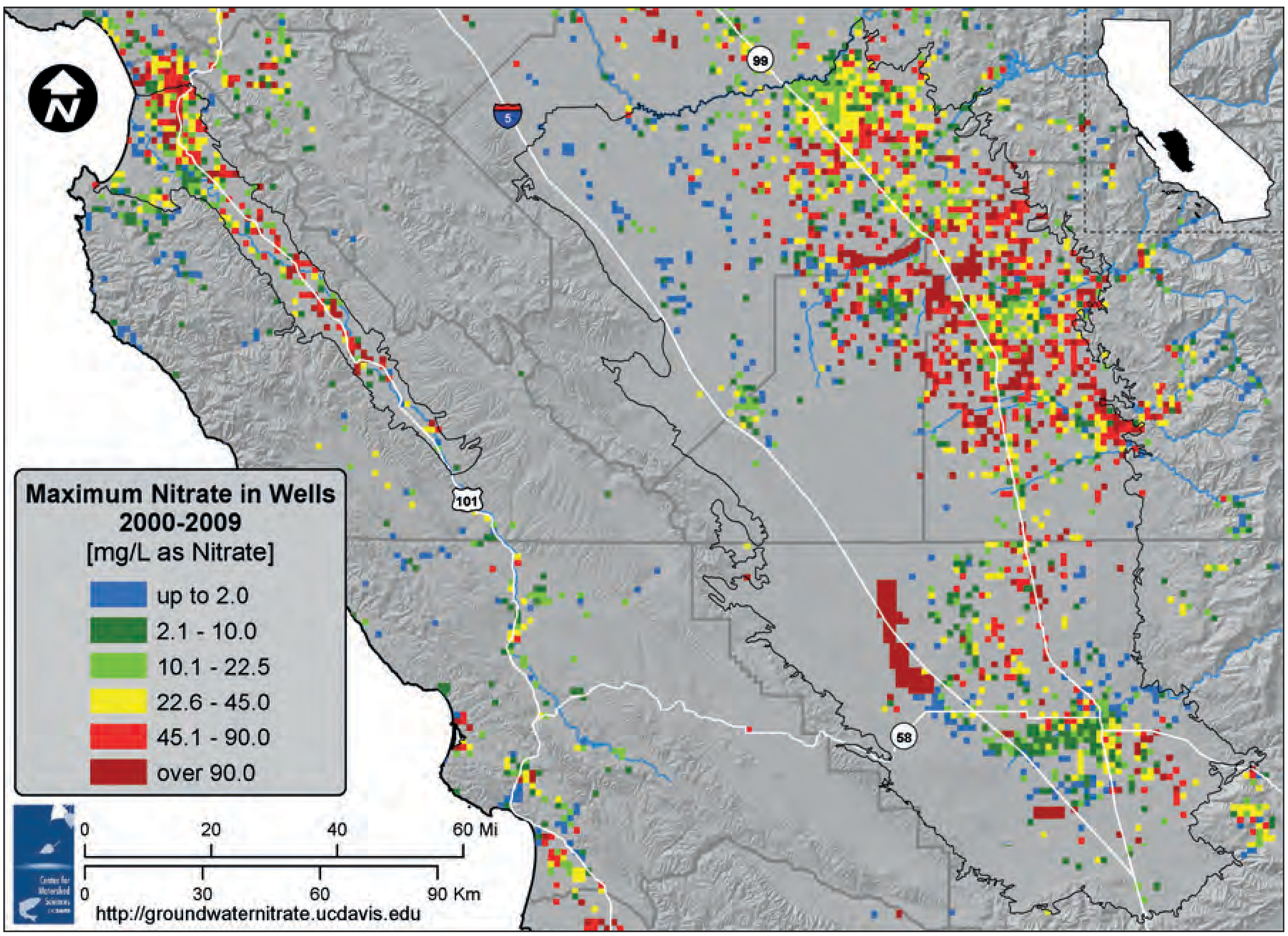


Figure 12. Maximum nitrate concentration (mg/L) measured at any time during 2000–2009 within a 1-square-mile land section. Some areas in the TLB are larger than 1 square mile. Source: Boyle et al. 2012.

are summarized in Table 8a. These programs/statutes have components that target nitrate source reduction or groundwater remediation. While providing a framework to address the groundwater nitrate issue, these programs have not been effective at preventing substantial nitrate contamination of groundwater used in drinking water supplies. Table 8b is a summary of current programs and statutes related to groundwater nitrate and drinking water. These provide for data collection, information, and education on nitrate sources and groundwater nitrate. Some of these programs regulate nitrate in drinking water.

In addition, several state, federal, and local agencies, as well as nongovernmental organizations, have established funding programs related to nitrate contamination in California's groundwater. A summary of existing funding sources to address problems related to nitrate in drinking water is shown in Table 9. In general, these programs are structured to provide assistance for activities related to alternative water supplies and nitrate load reduction. The State of California has eighteen relevant funding programs, administered by four agencies (Table 9, purple); the federal government manages an additional three funding programs (blue). Three large nongovernmental drinking water funding programs in the study area are highlighted in orange in Table 9. For a more detailed review, see Canada et al. (2012).

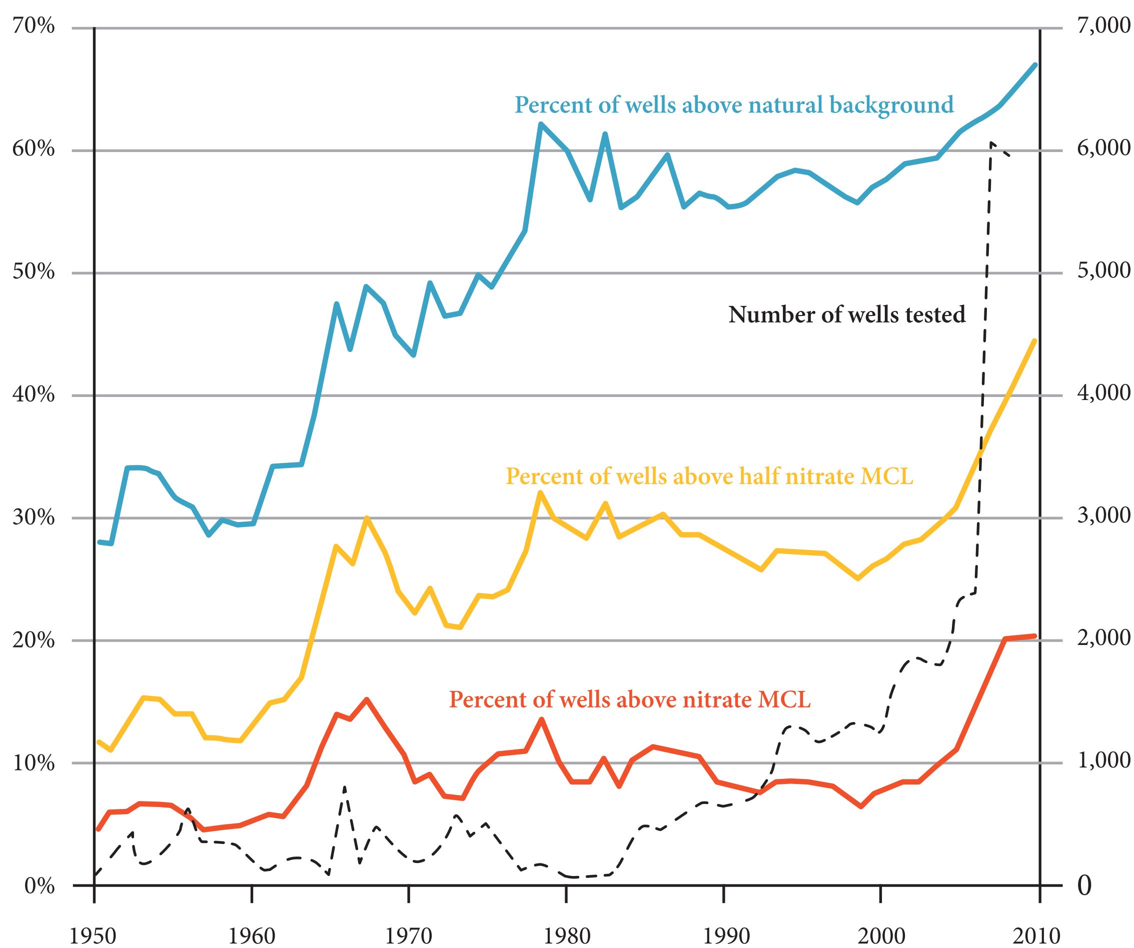


Figure 13. Five-year moving average of the percentage of wells for which the average annual measured concentration exceeded 9 mg/L (background), 22.5 mg/L (half of the MCL), and 45 mg/L (MCL) in any given year. Since the 1990s, an increasing number of wells other than public supply wells have been tested. In 2007, Central Valley dairies began testing their domestic and irrigation wells on an annual basis. Source: Boyle et al. 2012.

Table 7. Total groundwater volume* and estimated remediation volume by sub-basin

Sub-Basin	Total Groundwater Volume in Study Area km³ [million AF]	Remediation Volume > MCL km³ (% of total)	Remediation Volume > MCL million AF (% of total)
Tulare Lake Basin			
5-22.06–Madera	1.48 [1.2]	0.15 (10%)	0.12 (10%)
5-22.07–Delta-Mendota	3.21 [2.6]	0.16 (5%)	0.13 (5%)
5-22.08–Kings	115 [93]	12.75 (11%)	10.34 (11%)
5-22.09–Westside	64 [52]	1.67 (3%)	1.35 (3%)
5-22.10–Pleasant Valley	4.9 [4.0]	1.11 (23%)	0.90 (23%)
5-22.11–Kaweah	42 [34]	9.12 (21%)	7.39 (21%)
5-22.12–Tulare Lake	46 [37]	4.65 (10%)	3.77 (10%)
5-22.13–Tule	41 [33]	4.29 (11%)	3.48 (11%)
5-22.14–Kern	49 [40]	5.81 (12%)	4.71 (12%)
TLB TOTAL	366 [297]	39.7 (11%)	32.2 (11%)
Salinas Valley			
3-4.01–180/400 Foot Aquifer	8.46 [6.86]	0.91 (11%)	0.74 (11%)
3-4.02–Eastside	3.16 [2.56]	1.23 (39%)	1.00 (39%)
3-4.04–Forebay	5.59 [4.53]	1.37 (25%)	1.11 (25%)
3-4.05–Upper Valley	3.03 [2.46]	0.56 (19%)	0.45 (19%)
3-4.08–Seaside	0.78 [0.63]	0.07 (10%)	0.06 (10%)
3-4.09–Langley	0.44 [0.36†]	0.04 (9%)	0.03 (9%)
3-4.10–Corral de Tierra	0.60 [0.49‡]	0.002 (0.5%)	0.002 (0.5%)
SV TOTAL	22.1 [17.9]	4.19 (19%)	3.4 (19%)
Study Area Total	**315 [255]**	**43.9 (11%)**	**35.6 (11%)**

Source: King et al. 2012.

*Source: DWR 2010.

† Storage; actual groundwater volume not listed.

‡ Source: Montgomery Watson Americas 1997, not listed in DWR Bulletin 118.

Table 8a. Summary of programs and statutes for reducing nitrate contamination in groundwater

Agency	Program/Statute (year created/passed)	Goal/Purpose
U.S. Environmental Protection Agency (U.S. EPA)	Supplemental Environmental Programs (SEP) (1998)	Environmentally beneficial project that a violator of environmental laws may choose to perform (under an enforcement settlement) in addition to the actions required by law to correct the violation.
State Water Resources Control Board (State Water Board)	Porter-Cologne Water Quality Control Act (1969)	Grants the State Water Board authority over state water quality policy and aims to regulate activities in California to achieve the highest reasonable water quality.
	Recycled Water Policy (2009)	Resolution No. 2009-0011: Calls for development of salt and nutrient management plans and promotes recharge of clean storm water.
Regional Water Quality Control Boards	Cleanup and Abatement Order (CAO)	CA Water Code § 13304: Allows the Regional Water Board to issue a directive to a polluter to require clean up of waste discharged into waters of the state.
Central Coast Regional Water Quality Control Board	Irrigated Lands Regulatory Program (ILRP) (2004, draft in 2011)	*General Conditional Waiver of Waste Discharge Requirements, 3-Tiered Agricultural Regulatory Program (2004):* Groundwater quality monitoring required to different degrees based on discharger's tier. Draft (2001) requires Tier 3 dischargers with high nitrate loading to meet specified Nitrogen Mass Balance Ratios or implement a solution that leads to an equivalent nitrate load reduction.
Central Valley Regional Water Quality Control Board	Irrigated Lands Regulatory Program (ILRP) (2003, draft in 2011)	*Conditional Wavier of Waste Discharge Requirements of Discharges from Irrigated Lands:* Interim program to regulate irrigated lands. Does not address groundwater. *Recommended ILRP Framework (2011):* Development of new monitoring and regulatory requirements (includes groundwater).
	CV-SALTS (2006)	Planning effort to develop and implement a basin plan amendment for comprehensive salinity and nitrate management.
	Dairy Program (2007)	*Waste Discharge Requirements General Order for Existing Milk Cow Dairies:* Confined animal facilities must comply with set statewide water quality regulations, and existing milk cow dairies must conduct nutrient and groundwater monitoring plans.
California Department of Food and Agriculture (CDFA)	Feed, Fertilizer, Livestock, Drugs, Egg Quality Control Regulatory Services (FFLDERS)	Manages licenses, registration and inspection fees, and a mill fee levied on fertilizer sales, to fund research and educational projects that improve fertilizer practices and decrease environmental impacts from fertilizer use.

Table 8b. Summary of programs and statutes related to groundwater nitrate and drinking water (data collection, information, education, or regulation of drinking water)

Agency	Program/Statute (year created/passed)	Goal/Purpose
U.S. Environmental Protection Agency (U.S. EPA)	Safe Drinking Water Act (SDWA) (1974, 1986, 1996)	Mandates EPA to set the drinking water standards and to work with states, localities, and water systems to ensure that standards are met.
	Phase II Rule (1992)	Established federal maximum contaminant level (MCL) for nitrate in public water systems.
	Enforcement Response Policy—Enforcement Targeting Tool	Focuses on high-priority systems with health-based violations or with monitoring or reporting violations that can mask acute health-based violations.
U.S. Department of Agriculture (USDA)	Rural Utilities Service: National Drinking Water Clearinghouse (1977)	Provides technical assistance and educational materials to small and rural drinking water systems.
California Department of Public Health (CDPH)	22 CCR § 64431	Established state maximum contaminant level (MCL) for nitrate in public water systems.
	Drinking Water Source Assessment and Protection (DWSAP)	Evaluation of possible contaminating activities surrounding groundwater and surface water sources for drinking water.
	Expense Reimbursement Grant Program (EPG)	Education, training, and certification for small water system (serving < 3,301 people) operators.
	Groundwater Ambient Monitoring and Assessment (GAMA)	Improves statewide groundwater monitoring and increases availability of groundwater quality information. Funded by Prop 50 and special fund fees.
Assembly Bill 3030	(1993)	Permits local agencies to adopt programs to manage groundwater and requires all water suppliers overlying useable groundwater basins to develop groundwater management plans that include technical means for monitoring and improving groundwater quality.
Kern County Water Agency (KCWA)	(1961)	Collects, interprets, and distributes groundwater quality data in Kern County.
Monterey County Health Department		Implements a tiered, regular nitrate sampling program based on increasing nitrate concentration for local small water systems and for state small water systems.
Southern San Joaquin Valley Water Quality Coalition	(2002)	Protects and preserves water quality in the Tulare Lake Basin through surface water quality monitoring and dissemination of collected data. Particular focus is on agricultural discharge areas. Does not currently focus on groundwater.
Tulare County Water Commission	(2007)	Discusses water issues impacting Tulare County and advises the Tulare County Board of Supervisors. Special focus on nitrate in groundwater and improving drinking water in small communities.
Monterey County Water Resources Agency (MCWRA)	(1947)	Provides water quality management and protection through groundwater quality monitoring (including nitrate levels) and research and outreach efforts to growers to improve fertilizer management and reduce nitrate leaching.
The Waterkeeper Alliance	Monterey Coastkeeper (2007)	Collaborates with the State Water Board to ensure effective monitoring requirements for agricultural runoff and more stringent waste discharge requirements for other nitrate sources.
Rural Community Assistance Partnership (RCAP)	(1979)	Uses publications, training, conferences, and technical assistance to help communities of less than 10,000 people access safe drinking water, treat and dispose of wastewater, finance infrastructure projects, understand regulations, and manage water facilities.
National Rural Water Association (NRWA)	(1976)	Offers drinking water system technical advice (operation, management, finance, and governance) and advocates for small/rural systems to ensure regulations are appropriate.
California Rural Water Association	(1990)	Provides online classes, onsite training, low-cost educational publications, and other forms of technical advice for rural water and wastewater systems.
Self-Help Enterprises (SHE)	Community Development Program (1965)	Provides technical advice and some seed money to small/rural/poor communities for the planning studies and funding applications associated with drinking water system projects.
Community Water Center	Association of People United for Water (AGUA) (2006)	Advocates for regional solutions to chronic local water problems in the San Joaquin Valley. Focused on securing safe drinking water, particularly from nitrate-impacted sources.

Table 9. Summary of existing funding sources for water quality investigations and safe drinking water

Agency	Program (year passed or created)	Funding Provided (in millions of dollars)
California Department of Public Health (CDPH)	Safe Drinking Water State Revolving Fund (SDWSRF) (1996) (grants and loans)	**Generally $100–$150:** Low-interest loans and some grants to support water systems with technical, managerial, and financial development and infrastructure improvements.
	Proposition 84 (2006) (grants) **(fully allocated)**	**$180:** Small community improvements. **$60:** Protection and reduction of contamination of groundwater sources. **$10:** Emergency and urgent projects.
	Proposition 50 (2002) (grants) **(fully allocated)**	**$50:** Water security for drinking water systems. **$69:** Community treatment facilities and monitoring programs. **$105:** Matching funds for federal grants for public water system infrastructure improvements.
State Water Resources Control Board (State Water Board)	Clean Water State Revolving Fund (CWSRF) (1987) (loans)	**$200–$300 per year:** Water quality protection projects, wastewater treatment, nonpoint source contamination control, and watershed management.
	Small Community Wastewater Grants (2004, amended 2007) (grants)	**$86 (fees on the CWSRF):** Loan forgiveness to small disadvantaged communities and grants to nonprofits that provide technical assistance and training to these communities in wastewater management and preparation of project applications.
	Proposition 50 (2002) (grants) **(fully allocated)**	**$100:** Drinking water source protection, water contamination prevention, and water quality blending and exchange projects.
	Agricultural Drainage Program (1986) (loans) **(fully allocated)**	**$30:** Addressing treatment, storage, conveyance or disposal of agricultural drainage.
	Dairy Water Quality Grant Program (2005) (grants) **(fully allocated)**	**$5 (Prop 50):** Regional and on-farm dairy projects to address dairy water quality impacts.
	Nonpoint Source Implementation Program (2005) (grants)	**$5.5 per year:** Projects that reduce or prevent nonpoint source contamination to ground and surface waters.
	Cleanup and Abatement Account (2009)	**$9 in 2010:** Clean up or abate a condition of contamination affecting water quality.
	Integrated Regional Water Management (IRWM) (2002) (grants) **(fully allocated)**	**$380 (Prop 50):** Planning ($15) and implementation ($365) projects related to protecting and improving water quality, and other projects to ensure sustainable water use.

continued on next page

Table 9. *Continued*

Agency	Program (year passed or created)	Funding Provided (in millions of dollars)
California Department of Water Resources (DWR)	Integrated Regional Water Management (IRWM) (2002) (grants)	**$500 remaining (Prop 84):** Regional water planning and implementation.
	Local Groundwater Assistance Grant (2008) (grants)	**$4.7 anticipated for 2011–2012 (Prop 84):** Groundwater studies, monitoring and management activities.
	Proposition 82 (1988) (loans)	**$22:** New local water supply feasibility and construction loans.
	Water Use Efficiency Grant Program (2001) (grants)	**$15 in 2011 (Prop 50):** Water use efficiency projects for agriculture, such as: wellhead rehabilitation, water and wastewater treatment, conjunctive use, water storage tanks.
	Agricultural Water Conservation Loan Program (2003) (loans)	**$28 (Prop 13):** Agricultural water conservation projects, such as: lining ditches, tailwater or spill recovery systems, and water use measurement.
	Infrastructure Rehabilitation Construction Grants (2001) (grants) **(fully allocated)**	**$57 (Prop 13):** Drinking water infrastructure rehabilitation and construction projects in poor communities.
California Infrastructure and Economic Development Bank (I-Bank)	Infrastructure State Revolving Fund (ISRF) (1994) (loans)	**$0.25 to $10 per project:** Construction or repair of publicly owned water supply, treatment, and distribution systems.
U.S. Department of Agriculture (USDA)	Rural Utilities Service—Water and Environmental Programs (RUS WEPs) (loans and grants)	**$15.5:** Development and rehabilitation of community public water systems (less than 10,000 people), including: emergency community water assistance grants, predevelopment planning grants, technical assistance, guaranteed loans, and a household well water program.
U.S. Department of Housing and Development (HUD)	Community Development Block Grant (CDBG) (grants)	**$500 in 2010 for CA:** Community development projects: feasibility studies, final plans and specs, site acquisition and construction, and grant administration.
U.S. Department of Commerce	Economic Development Administration (EDA) (grants)	**Grants up to 50% of project costs:** supports economic development, planning, and technical assistance for public works projects.
Rural Community Assistance Corporation (RCAC)	Drinking Water Technical Assistance and Training Services Project (loans)	**$1.2 per year:** Administers funds from the US EPA Office of Groundwater & Drinking Water for infrastructure projects, including water.
The Housing Assistance Council (HAC)	Small Water/Wastewater Fund (loans)	**Up to $0.25 per project:** Loans for land acquisition, site development, and construction.
Cooperative Bank (CoBank)	Water and Wastewater Loan (loans)	**$1 per project:** Water and wastewater infrastructure, system improvements, water right purchases, and system acquisitions. **$0.05–$0.5 per project:** Construction costs.

Source: Canada et al. 2012.

The Dutch Experience

In response to increasingly intensive animal production and a growing awareness of its effects on nitrate concentrations in surface water and groundwater, the European Council Nitrate Directive (ND) (Council Directive 91/67/EEC) was established in 1991 as part of the European Union (EU) Water Framework. The ND imposes a performance standard of 50 mg/L nitrate on effluent, groundwater, and surface water quality levels within all EU countries. Furthermore, each country is required to establish nitrate contamination reduction plans, monitor program effectiveness, and regularly report their findings to the European Council (EC) (EU Publications Office). Compliance with the ND is costly in terms of time, expertise, and money; however, countries that do not meet ND standards face large fines from the EC. While the ND does very little in the way of explicitly specifying how countries should act in efforts to comply with these requirements, plans that do not propose to regulate manure application at ND standards (i.e., land application rates in the range of 170–210 kg N/ha) have been historically rejected.

As an agricultural hotspot, The Netherlands has struggled to meet the ND requisites. To fulfill the obligatory ND requirements (Ondersteijn 2002), the Dutch government first created the Mineral Accounting System (MINAS) in 1998 (Henkens and Van Keulen 2001). MINAS was a farm-gate policy created to ensure the balance of nitrogen and phosphorus inputs (fertilizer and feed) and outputs (products and manure) on individual farms via balance sheets (Oenema et al. 2005). MINAS resembled a farm-gate performance standard that was enforced by a penalty tax for excess nitrogen and phosphorus inputs: farms consuming more nitrogen or phosphorus than could be accounted for via harvest outputs would be fined per kilogram of nitrogen or phosphorus lost to the environment. As of 2003, fines of € 2.27/kg N ($1.40/lb N) were enforced, more than seven times the cost of nitrogen fertilizer at the time. MINAS was popular for its simplicity, and was well supported by government aid. RIVM (Netherland's National Institute for Public Health and the Environment), which monitors nitrogen and phosphorus soil and water concentrations nationally, reports that nitrogen surpluses in agricultural areas fell substantially beginning in 1998 as a result of its implementation. Nevertheless, the EU declared the Dutch MINAS policy noncompliant with ND requirements, stating that the policy did not directly regulate water nitrate concentrations (Henkens and Van Keulen 2001).

In response to the EU's rejection of MINAS, the Netherlands implemented an additional policy in 2002: the Mineral Transfer Agreement System (MTAS). MTAS was a cap-and-trade system that prescribed manure (not inorganic fertilizer) application rates (as per ND objectives) and allowed farmers to purchase surplus application rights from those farmers applying manure to their land below legal limits. Rather than repealing MINAS, however, the Dutch increased enforceable fines under MINAS to serve as a safety net under the newly implemented MTAS (Ondersteijn 2002). Following the enactment of MTAS, water nitrate levels continued to fall at pre-MTAS rates (Henkens and Van Keulen 2001; Ondersteijn 2002; Berentsen and Tiessink 2003; Helming and Reinhard 2009), suggesting that the implementation of MTAS in addition to MINAS had little or no additional effect.

Given the apparent futility of MTAS, and following the repeated rejection of MINAS by the European court of justice in 2003, both MTAS and MINAS were abandoned by the Dutch government by 2006. The two competing regulations were replaced by a composite policy that enforces nitrogen as well as phosphorus application standards for both manure and inorganic fertilizer, thereby satisfying both ND standards and the unique challenges encountered in Dutch territory, while minimizing administrative and economic costs. The composite policy remains in effect to date.

4 Impact: Drinking Water Contamination

About 2.6 million people in the Tulare Lake Basin and Salinas Valley rely on groundwater for drinking water. This section estimates the population susceptible to nitrate contamination of groundwater, identifies safe drinking water actions available and the most promising options to address nitrate groundwater contamination, and estimates the total cost of nitrate contamination to communities and households in these areas. This discussion summarizes more detailed examinations by Jensen et al. (2012) and Honeycutt et al. (2012).

4.1 Susceptible Populations

Groundwater nitrate contamination brings two forms of susceptibility: public health risks and the economic costs of avoiding such risks through treatment, source reduction, remediation, or alternative water supplies. California's Tulare Lake Basin and Salinas Valley are particularly susceptible to public health and financial risks from nitrate contamination for the following reasons (Honeycutt et al. 2012).

- Communities in this region are unusually dependent on groundwater. Less than 3% of the area's population is served by surface water alone.
- These areas have more and larger nitrate contamination sources than most other parts of California (Viers et al. 2012).
- Of the region's 402 community public and state-documented state small water systems, 275 are very small (15–500 connections) and 58 are small (501–3,300 connections) (Figure 14). Small and very small systems are about 81% of Tulare Lake Basin water systems (serving 89,125 people, 4% of the population) and about 89% of the Salinas Valley water systems (serving 23,215 people, 6% of the population).
- Many of these small systems rely on a single well, without emergency alternatives when contamination is detected. These small water systems are inherently less reliable and face higher per capita expenses to address nitrate contamination of groundwater.
- Roughly 10.5% and 2.6% of the populations of Tulare Lake Basin and Salinas Valley, respectively, use unregulated, unmonitored domestic wells, serving 245,000 people from 74,000 wells (Figure 15).
- The area has many poor communities that cannot afford drinking water treatment or capital-intensive alternative water supplies. Over 17% of the Tulare Lake Basin and 10% of the Monterey County population lives in poverty.

We estimated the population of these basins that is susceptible to significant financial cost and public health concerns from nitrate contamination in groundwater (Honeycutt et al. 2012). The drinking water source (groundwater well or surface water), history of nitrate contamination, size, and potential for contamination were considered for each water system and self-supplied rural household well location in this region. "Vulnerability" describes the intrinsic potential for a system to deliver drinking water to users with high nitrate levels based on the type of system and based on the number of water sources within the system. Vulnerability is scored as follows:

- Lower vulnerability is assigned to community public water systems (water systems with >15 connections) having more than one water source (i.e., more than one well), regardless of whether they treat their water to remove nitrate.
- Higher vulnerability is assigned to all other water systems: community public water systems with a single source (one well) and state small (5–14 connections), local small (2–4 connections), and household self-supplied water systems (domestic well).
- No vulnerability to nitrate groundwater contamination is assigned to water systems solely supplied by surface water.

Susceptible water users could be harmed by consuming drinking water containing contaminants or by the costs for avoiding such contamination. We define "susceptible population" as those

- served by a water system with multiple sources (wells) that has reported at least one delivered water nitrate MCL exceedance in the past 5 years, or
- served by a water system with a single source (well) that has reported at least one raw water nitrate MCL exceedance in the past 5 years, or

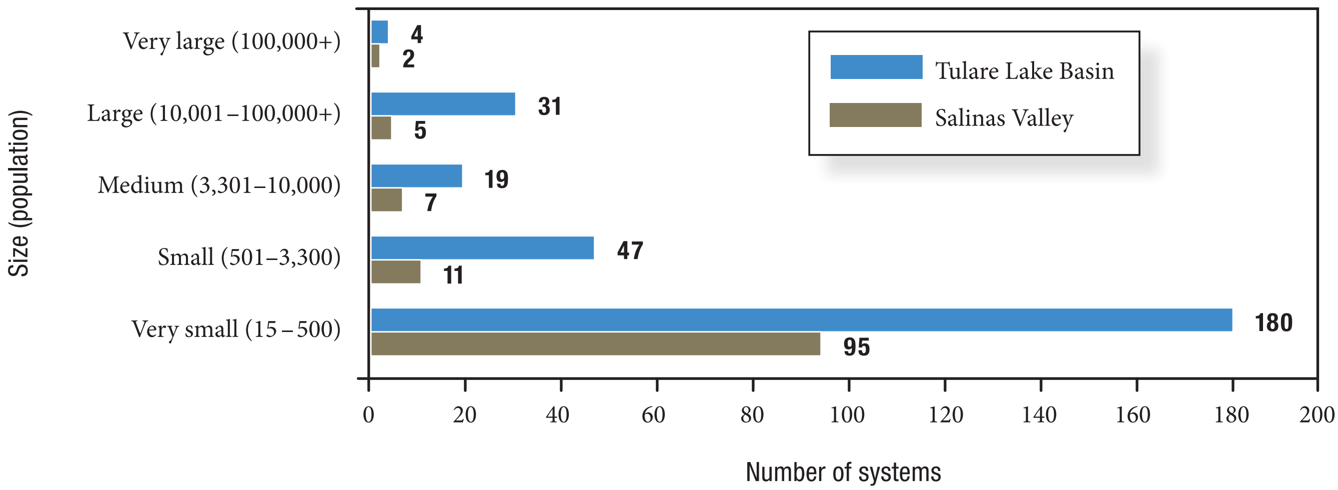


Figure 14. Community public and state-documented state small water systems of the Tulare Lake Basin and Salinas Valley. Source: CDPH 2010.

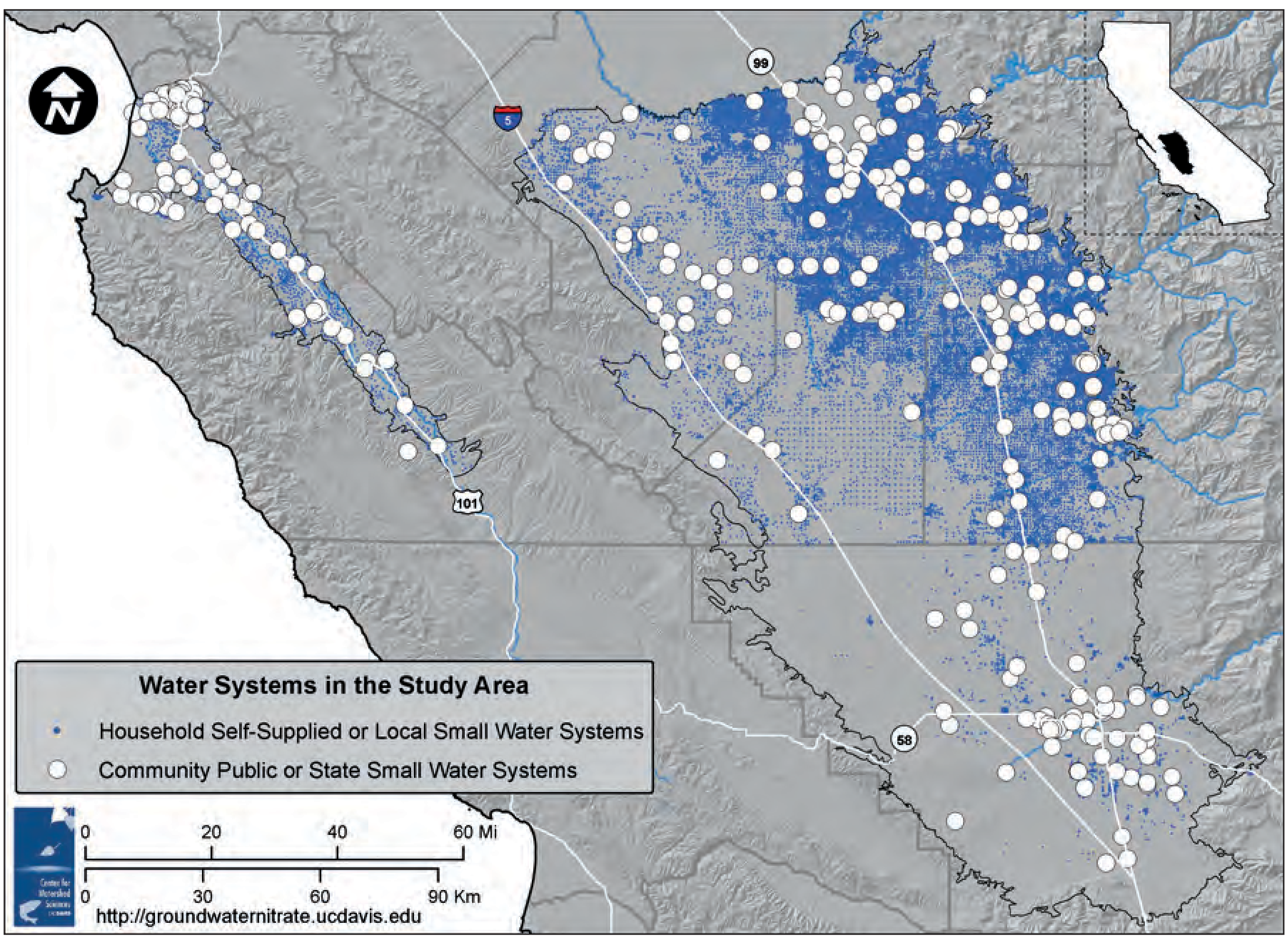


Figure 15. Estimated locations of the area's roughly 400 regulated community public and state-documented state small water systems and of 74,000 unregulated self-supplied water systems. Source: Honeycutt et al. 2012; CDPH PICME 2010.

- relying on domestic wells or local small water systems (fewer than 5 connections) in an area where shallow groundwater (<300 feet) has exceeded the nitrate MCL in the past (1989–2010), based on data from the UC Davis CASTING dataset (Boyle et al. 2012) or
- served by a water system lacking nitrate water quality data.

Figure 16 shows how these categorizations were used to classify populations and water systems. Of the 2.6 million people in the Tulare Lake Basin and Salinas Valley, 254,000 people have drinking water supplies susceptible to significant nitrate contamination. Of these, about 220,000 are connected to 85 community public or state small water systems with high or unknown susceptibility. For the majority of these systems, treatment will be expensive due to their small size (lack of economies of scale).

About 34,000 people are served by about 10,000 self-supplied household wells or local small water system wells at high risk for nitrate contamination given the known raw water quality exceedances in nearby wells (Figure 17). These systems are currently not regulated by the state or counties, and little public monitoring data exist for them.

Nine of 105 single-source small water systems in the study area exceeded the nitrate MCL at least once since 2006 and are not currently treating their water (CDPH 2010). Currently, 13 groundwater-supplied

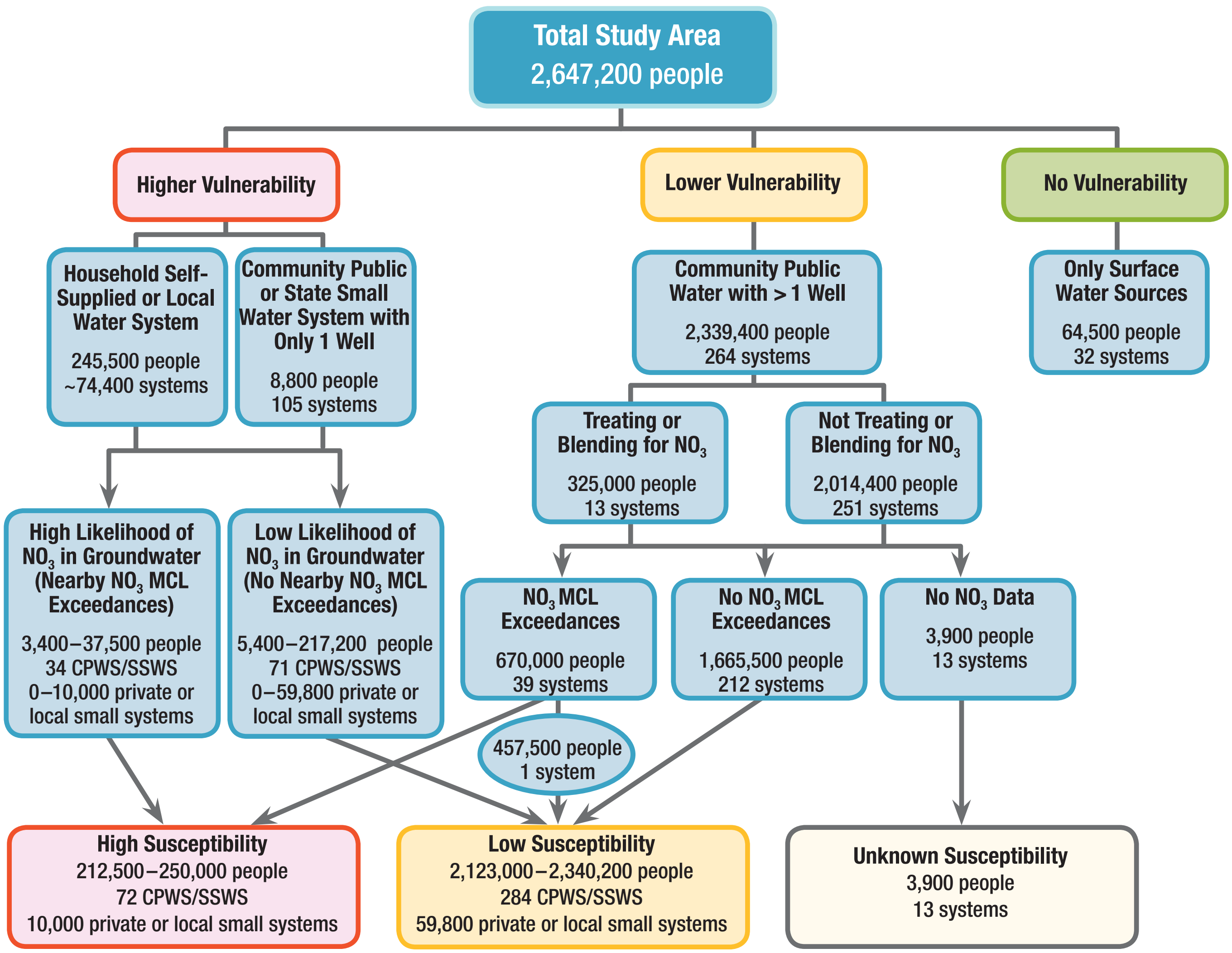


Figure 16. Classification of susceptible populations based on estimated vulnerability and water quality data for the study area. Due to different sources of data, the summation of the top row does not equal the total study area population. All population and connection information is approximate. CPWS: community public water system; SSWS: state small water system. Source: Honeycutt et al. 2012.

community public water systems and state small water systems treat for nitrate: 8 treat by blending and 5 by treatment processes (4 by ion exchange [IX] and 1 by reverse osmosis [RO]).

About 45% of the multiple-source systems that have delivered water exceeding the nitrate MCL serve severely disadvantaged and disadvantaged communities (SDACs and DACs) (Figure 18). DACs that are unincorporated, known as DUCs, often lack central water and sewer services. These DUCs are highly susceptible to nitrate contamination because they may lack a safe water source and are less financially able to resort to alternatives if their water source becomes contaminated. Since these areas have a large concentration of families with low incomes, community solutions to nitrate treatment or alternative water supply also might be difficult.

Over 2 million people in the study area are not classified as susceptible to a public health risk for nitrate contamination today. However, more than half of the study area population is considered to be at financial risk from nitrate contamination, having to potentially pay higher costs for treatment and monitoring because of regional groundwater contamination: A total of 1.3 million people (57%) in the area are served by community public water systems or state small water systems in which raw water sources have exceeded the nitrate MCL at least once between 2006 and 2010 (Figure 1 and Table 10). This includes over 457,000 people in the City of Fresno, which has nitrate exceedances in some wells but is taking measures to avoid this contamination, including significant expansion of surface water use.

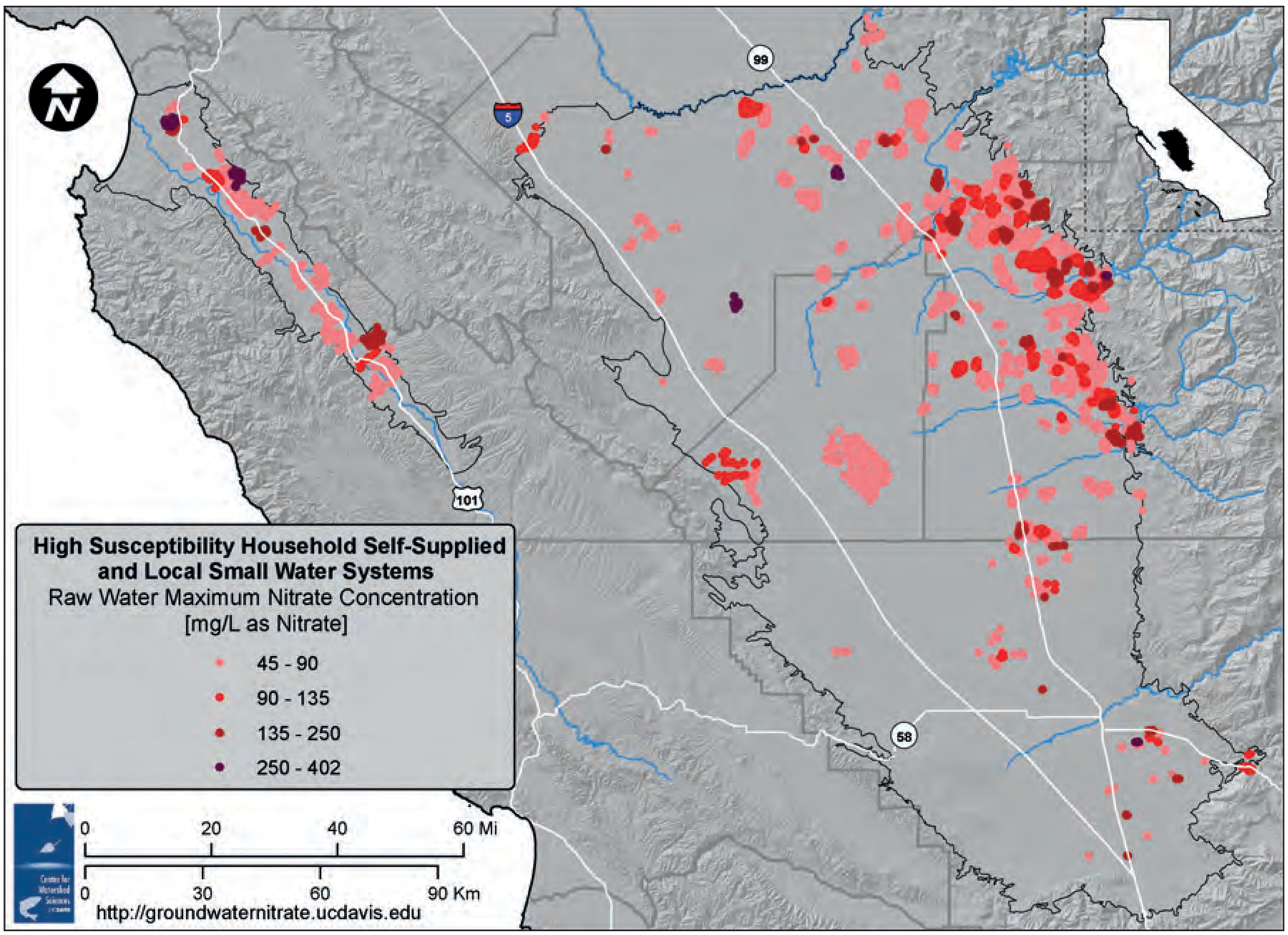


Figure 17. Household self-supplied and local small water systems located near wells having a maximum nitrate concentration value greater than the MCL. Source: 1989–2010 CASTING Database: GAMA, DWR, SWB, CDPH-CADWSAP, USGS, County Officials, Land Use Parcel Codes and DWR Land Use (see Honeycutt et al. 2012).

Severely disadvantaged communities (SDACs) are particularly vulnerable to financial costs. Of 51 community public water systems (serving about 714,000 people) in the study area with a raw source exceeding the nitrate MCL, most systems (40, serving about 379,000 people) are in a DAC. Thirteen of the 40 exceeding systems are in unincorporated areas (serving about 167,000 people), and 27 are in incorporated communities (serving about 212,000 people). They often cannot afford or organize and maintain capital-intensive solutions.

As past and current nitrogen applications migrate downward and through aquifers in the Tulare Lake Basin and Salinas Valley, populations susceptible to the costs and public health risks of nitrate contamination are likely to increase. Assuming unchanging and unabated basin-wide trends in CPWS raw nitrate groundwater levels since 1970, the financially susceptible population is estimated to increase from 57% currently to almost 80% or 1.9 million people by 2050 (not accounting for population growth, Table 10).

4.2 Alternative Water Supply and Treatment

Source reduction and aquifer remediation are insufficient to address drinking water nitrate contamination in the short- or near-term. In these cases, local water system authorities and users must select from a variety of treatment and alternative supply options. These options are summarized for community public water systems in Table 11 and for self-supplied

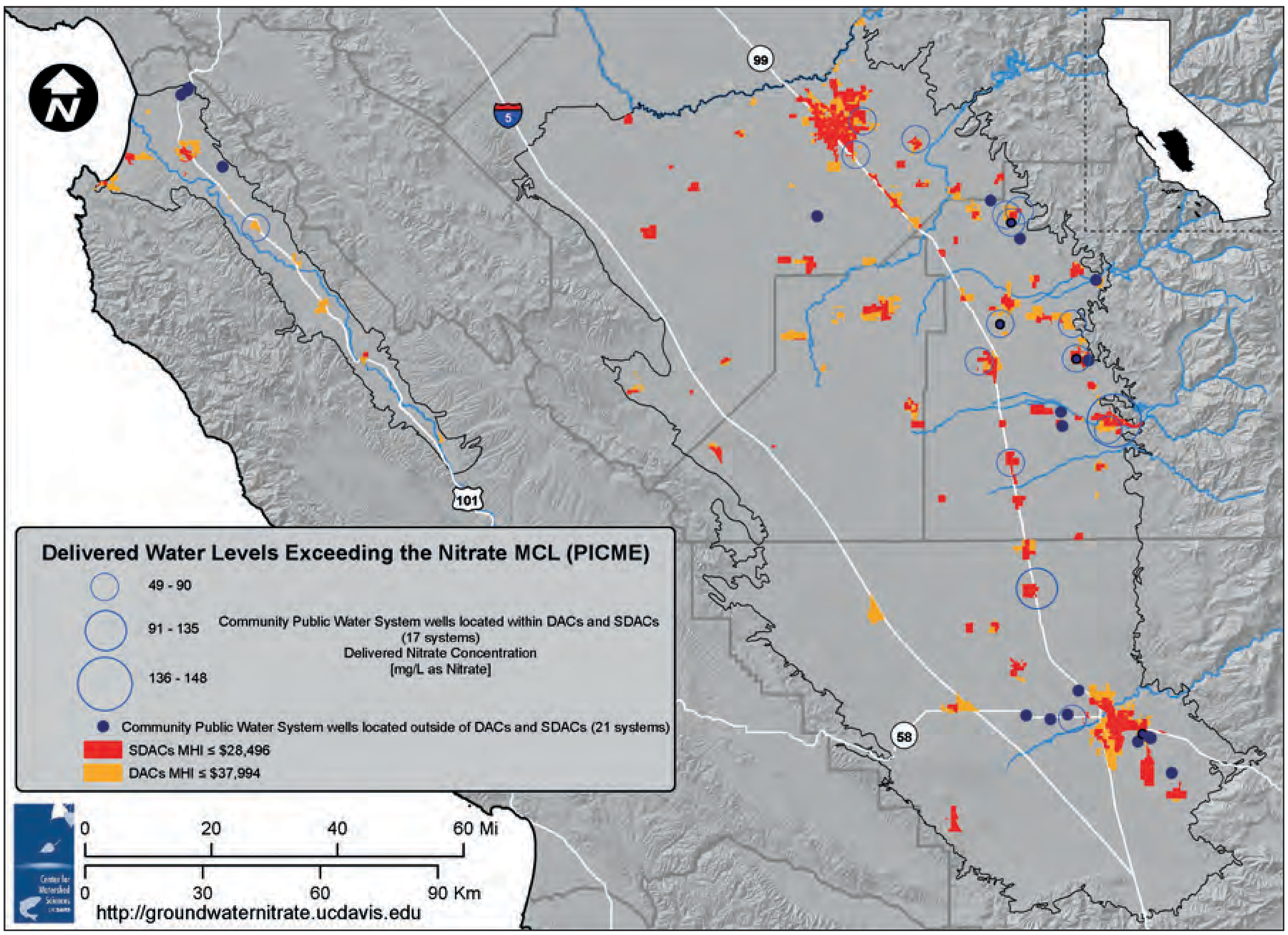


Figure 18. DACs, SDACs, and delivered water quality in multiple-source community public water systems. Source: CDPH PICME WQM 2006–2010; U.S. Census Bureau 2000, 2001 (see Honeycutt et al. 2012).

households and local small water systems in Table 12. This section further outlines these options (for details, see Honeycutt et al. 2012, and Jensen et al. 2012).

Community Public Water System Options

Each water system is unique, despite having many common problems and characteristics. No single solution will fit every community affected by nitrate in groundwater; each water system requires individual engineering and financial analysis.

The uniqueness of individual water systems is multiplied by the large number of small water systems in the Tulare Lake Basin and Salinas Valley. Small water systems have fewer and more expensive options per capita than do larger systems. They lack economies of scale and have fewer staff resources. Small water and wastewater systems also typically have disproportionately greater water quality and reliability problems and higher costs per capita (NRC 1997).

The options available for community public water systems faced with problems from nitrate contamination are summarized in Table 11. Blending is the most common approach to nitrate contamination for larger community public water systems with more than one water source. Water from the contaminated well is reduced, eliminated, or mixed with water from a safer water source. Eight community public water systems in the Tulare Lake Basin and Salinas Valley currently blend sources to comply with the nitrate MCL.[7]

Drilling a deeper or a new well is another common response to nitrate groundwater contamination. This approach can be cost-effective, but it is often only a temporary solution when nitrate contamination continues to spread locally and to deeper aquifers.

Treatment of community public water supplies is often explored and sometimes employed. A variety of treatment options are available (Jensen et al. 2012). Ion exchange and reverse osmosis are used for community public water system treatment in the basins. Additional treatment options, such as biological denitrification, may become economical and accepted in time (Jensen et al. 2012). However, treatment is expensive, especially for small systems. Under some circumstances, only a portion of extracted water is treated for nitrate because regulations can be met by blending treated water with water not treated for nitrate.

Management of waste concentrate or brine, by-products of ion exchange and reverse osmosis treatments, can also be costly. Options include discharge to a sewer or septic system, waste volume reduction using drying beds, trucking or piping for off-site disposal, deep well injection, and advanced treatment (Jensen et al. 2012).

Connecting to a larger system with reliable good-quality water can often solve many problems of small water systems, including nitrate contamination. This provides economies of scale in costs and greater access to expertise for resolving water system problems. However, connecting a small, often

Table 10. Estimated number of years until community public water supply (CPWS) sources exceed the nitrate MCL, and total affected population (not accounting for population growth)

Time for Maximum Recorded Raw Nitrate Level to Reach the MCL	Total Number of Affected CPWSs*	Total Affected Population*	Percent of Total CPWSs Population (study area)
0 years (2010)	77	1,363,700	57%
25 years (2035)	114	1,836,700	76%
40 years (2050)	127	1,903,300	79%

Source: Honeycutt et al. 2012.

* Based on raw water quality, not delivered quality susceptibility.

[7] Jensen et al. (2012) found a total of 23 water systems, including all types of water systems, in the study area that treat or blend to address the nitrate problem (10 blending systems, 10 IX systems, and 3 RO systems).

Table 11. Options for community public water systems

Option	Advantages	Disadvantages
Blending	• Simple nontreatment alternative. • Cost-effective, given suitable wells.	• Capital investment for accessing an alternative source. • Relies on availability and consistency of low-nitrate source. • Monitoring requirements. • Rising nitrate levels may preclude ability to blend.
Drilling a deeper or new well	• Potentially more reliable water supply. • Cheaper than bottled water for households using more than 8 gal/day.	• Potential decrease in source capacity. • Capital and operational costs increase with depth. • Potentially only a temporary quick fix; longevity depends on local hydrogeologic conditions and land use. • Risk of encountering other water quality concerns at greater depths (i.e., arsenic, manganese). • Pipeline costs if source area is far from original source.
Community treatment (IX, RO and EDR)	• Multiple contaminant removal. • Feasible, safe supply.	• Disposal of waste residuals (i.e., brine waste). • High maintenance and/or energy demands. • Resin or membrane susceptibility.
Piped connection to an existing system	• Safe, reliable water supply.	• Capital cost of pipe installation. • Connection fee. • Water rights purchase (surface water).
Piped connection to a new system	• Safe, reliable water supply.	• Capital cost of pipe installation. • High treatment system capital and O&M costs. • Water rights purchase (surface water).
Regionalization and consolidation	• Often lower costs.	• High capital and O&M costs.
Trucked water	• Community-wide distribution. • No start-up capital cost.	• Temporary "emergency" solution. • Not approved for new water systems.
Relocate households	• Safe, reliable water supply.	• Socially and politically difficult, extreme option. • Loss of property value and jobs. • Social, familial dislocation.
Well water quality testing (already in place)	• Water quality awareness. • Beneficial to blending.	
Dual system	• Hybrid of options. • Treating only potable.	• Possible consumption of contaminated source. • Cost of contaminated supply plus cost for POU system or trucked/bottled water, or capital dual plumbing costs.

Source: Honeycutt et al. 2012.

substandard system to a larger system often involves substantial initial capital costs to make the connection and to upgrade the smaller distribution system. Establishing connections also can pose institutional challenges (such as water rights and governance) and financial risks to the larger system.

Connecting several smaller systems into a new larger water system has many of the same advantages and costs of connecting small systems to an existing larger system. Establishing a new system also requires additional start-up costs for infrastructure and institutional development.

Institutional consolidation of several small systems avoids the costs of hydraulically connecting small systems, and it can provide a higher level of staff expertise and administrative economies of scale. This is attractive when systems are too small to merit full-time, trained staff and too scattered to economically connect their distribution systems and sources.

Trucking uncontaminated water to supply small communities allows the servicing of small scattered water systems, usually at a high cost. Trucking in water is generally seen as a temporary or emergency solution while a more permanent high-quality drinking water source is being developed.

Relocating households to a different area with better-quality water is an extreme approach that might be suitable if a small community is unviable for a variety of reasons and can not attract additional customer investments. Relocating households is likely to be accompanied by a loss of property values and local jobs, as well as social dislocation.

Two ancillary options that can supplement some of the above options are well water quality testing and the development of dual plumbing systems. Well water testing programs provide better and more timely information for awareness of nitrate contamination and can also provide useful information for blending. Dual plumbing systems separate potable from nonpotable water distribution systems, allowing a smaller quantity of contaminated water to be treated or conveyed from a higher-quality source for potable water uses.

The least expensive option is usually to stop using a nitrate-contaminated well and switch to another existing well, if a safer well is available. Similarly, many systems with more than one well blend water from a low-nitrate source or well with more contaminated supplies.

Self-Supplied Households and Local Small Water System Options

There are approximately 74,000 self-supplied households and local small water systems in the Tulare Lake Basin and Salinas Valley. Their nitrate contamination response options are summarized in Table 12 and discussed below.

Water supply options for self-supplied households and local small water systems are are similar to the options available to community public water systems, but are are similar to the options available to community public water systems, but are applied at a much smaller scale.

Drilling a deeper or new well can provide a reliable supply where better water quality exists. This option is costly, deeper wells can be accompanied by additional forms of contamination (such as arsenic), and new wells might provide only temporary relief if the nitrate plume is spreading deeper into the aquifer.

Treatment of household water supplies for nitrate is typically by reverse osmosis (RO). RO has advantages including the ability to remove multiple contaminants (where nitrate is not the only concern). However, household treatment does require some costs as well as additional burdens for maintenance, inspection, and operation of equipment. Treatment can be either point-of-entry (treating all household water use) or point-of-use (treating only potable water at household taps, usually the kitchen). As with centralized nitrate treatment, RO units create a concentrate or brine waste that requires disposal. Dilute waste streams, characteristic of RO, can sometimes be used for irrigation.

Connection to a larger system with more reliable water quality is a promising solution where a larger system is nearby. Such a connection often has a high cost, but it may provide a net economic benefit from lower long-term costs and delegation of many water quality concerns to qualified entities.

Trucking in water to the household or local small water system can be convenient and requires little start-up cost, but it is often expensive and is commonly considered to be a temporary solution. Bottled water use is similar to trucking in water, but it often entails a greater cost.

Households or local small water systems can relocate to avoid water quality problems, but this typically would involve some loss of property value. If the household or business is prosperous, relocation is unlikely. Poorer households are likely to feel any resultant loss of jobs or social dislocation more acutely.

Well water testing can better inform self-supplied users of their risks from nitrate contamination. These tests are not expensive. Dual plumbing systems can help reduce the amount of water that is trucked in or treated, but it imposes additional costs and some risk of cross-connection of contaminated and safe water supplies.

Treatment to Remove Nitrate

Contaminated groundwater can be treated at a community treatment plant for all users, at the point-of entry-to residential or commercial buildings, or at the point of potable drinking water use (such as the kitchen sink). A variety of treatment options are available (Jensen et al. 2012). Ion exchange and reverse osmosis are used for community public water system treatment (Figures 19 and 20). RO is often used for point-of-use treatment in households and businesses. Additional treatment options, such as biological denitrification, may become economical and accepted (see Jensen et al. 2012). The effectiveness of treatment technologies across nitrate concentrations is summarized in Table 13.

Table 12. Options for self-supplied households and local small water systems

Option	Advantages	Disadvantages
Drilling a deeper or new well	• Potentially more reliable water supply. • Cheaper than bottled water for households using more than 8 gal/day.	• Potential decrease in source capacity. • Capital and operational costs increase with depth. • Potentially only a temporary quick fix; the nitrate plume follows groundwater movement. • Risk of encountering other water quality concerns at greater depths (i.e., arsenic, manganese). • Pipeline costs required if source area is far from original source.
Household treatment (RO)	• Multiple contaminant removal. • Low-nitrate water supply.	• Unless instructed, risk of improper handling or maintenance of equipment.
Regionalization and consolidation	• Cheaper treatment costs on a customer basis.	• High capital and O&M costs.
Trucked water	• Community-wide distribution. • No start-up capital cost.	• Temporary "emergency" solution. • Extra potable water storage required if a small community.
Bottled water	• Nitrate-free water supply. • No start-up cost.	• Inconvenience, monthly expenditure. • Temporary solution.
Relocate households	• Safe, reliable water supply.	• Unpleasant, extreme option. • Loss of property value and jobs. • Social, familial dislocation.
Well water quality testing	• Water quality awareness. • Beneficial to blending.	
Dual system	• Hybrid of options. • Treating only potable.	• Possible consumption of contaminated source. • Cost of contaminated supply plus cost for community treatment of potable supply and dual plumbing costs.

Source: Honeycutt et al. 2012.

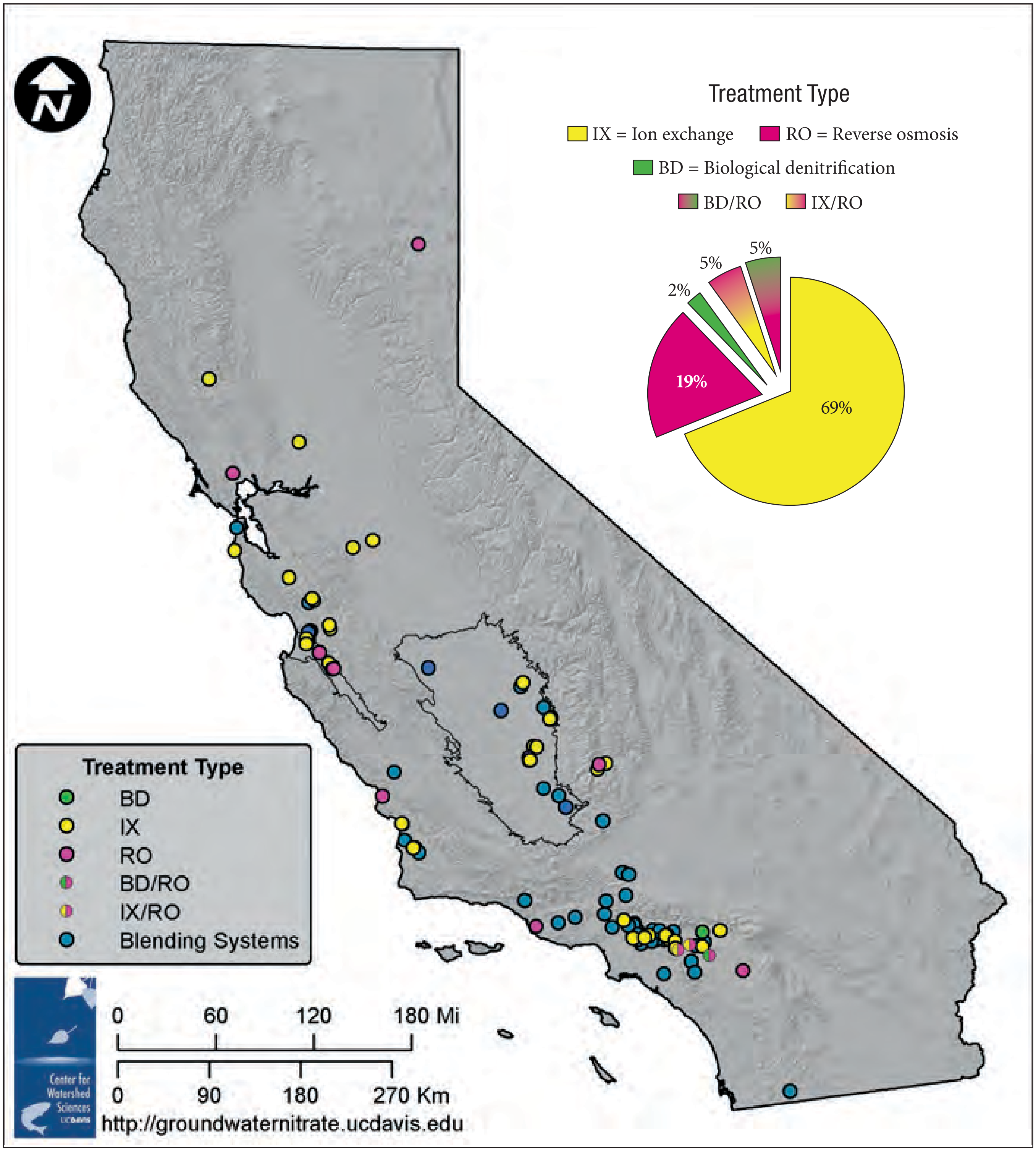


Figure 19. California drinking water systems treating or blending for nitrate, 2010. Source: Jensen et al. 2012.

However, treatment is expensive, especially for small systems. The development of treatment alternatives requires local engineering and development to accommodate local conditions. Nitrate contamination can be accompanied by other forms of groundwater contamination, including arsenic, magnesium, or pesticides, and treatment must accommodate the spectrum of water quality concerns as well as local water chemistry and distribution system conditions. Statewide, over 50% of nitrate treating systems utilize blending. Approximately 70% are using IX, and about 20% are using RO (Figure 19). In the Tulare Lake Basin and the Salinas Valley (Figure 20), 23 systems (of all types) were found to be treating and/or blending to address the nitrate problem (10 blending systems, 10 IX systems, and 3 RO systems).

Consolidation and Regionalization

Consolidation or regionalization of small systems is often suggested for addressing nitrate contamination and many other problems of small water systems. Although small systems are theoretically accountable and responsive to local customers, they often have diminished financial and technical resources that limit their ability to respond effectively or economically. Where a small system is near a larger system with superior water quality, connecting and consolidating these systems can provide a long-term remedy for the smaller system. Figure 21 shows the proximity of small systems (<10,000 people) in the Tulare Lake Basin and Salinas Valley to larger systems. Many small systems are reasonably close to potential long-term solutions.

However, the larger system may be concerned with financial and administrative burdens that may arise from upgrading the smaller system. Commonly, a smaller system must pay for the costs of connecting to a larger system as well as any distribution system upgrades needed to make the two systems compatible. This system upgrade burden on the financially weaker partner can require external financial assistance.

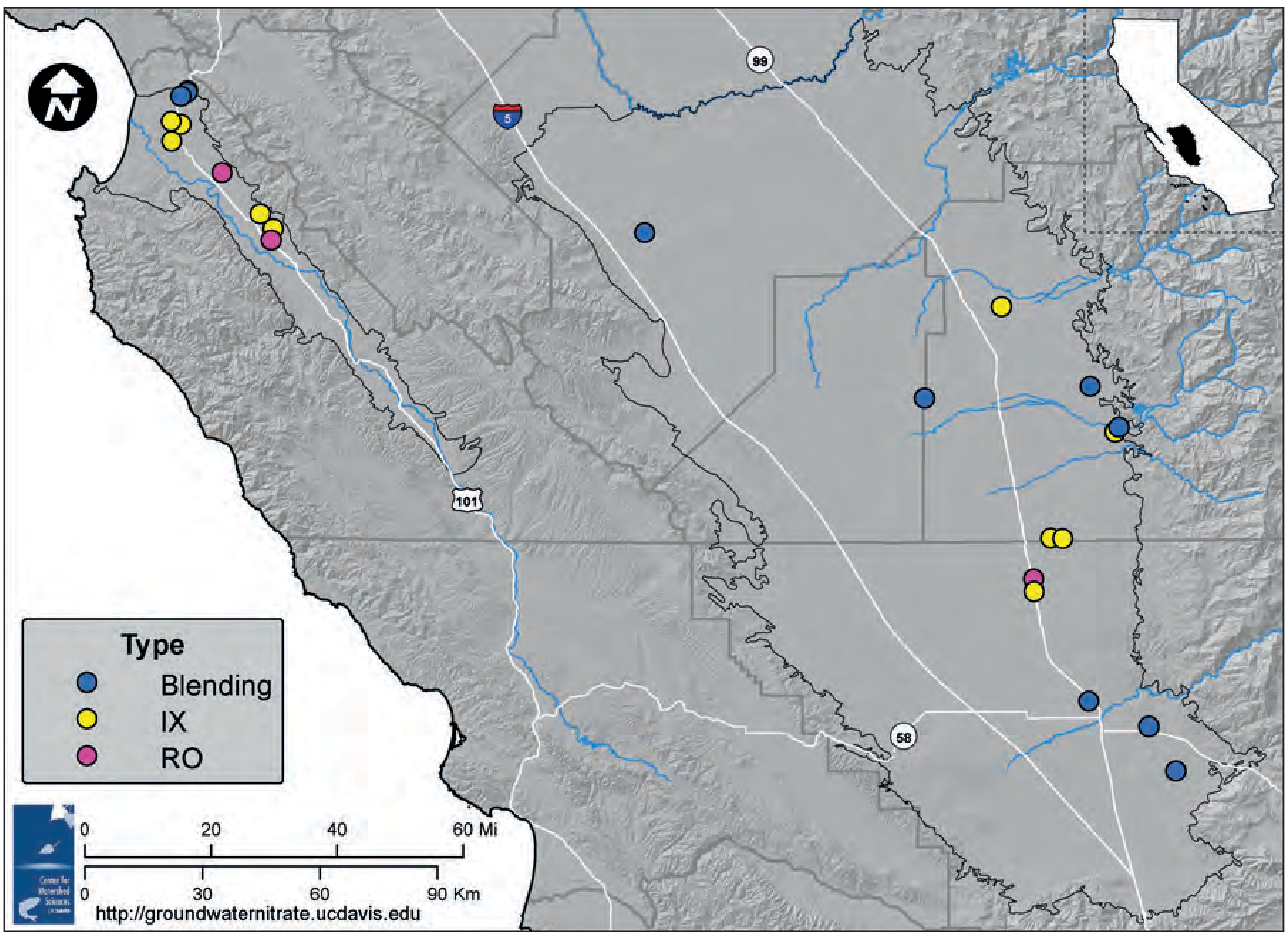


Figure 20. Utilities treating or blending for nitrate in the Salinas Valley and Tulare Lake Basin, 2010. Source: Jensen et al. 2012.

Many small systems are far from a larger system. For these cases, physical connection with a larger system is less financially attractive. However, even where systems remain hydraulically separated, consolidated operations, maintenance, and administration can sometimes have sufficient advantages to overcome financial barriers.

4.3 Comparison and Discussion

Economically promising and appropriate treatment and alternative water supply options have been identified (Honeycutt et al. 2012). These promising options give indications for state policy, and their costs are used to help estimate the overall cost of nitrate groundwater contamination in the Tulare Lake Basin and Salinas Valley.

Options for Small Community Public Water Systems

Estimated costs of options for community public water systems are compared in Table 14. Promising options for communities at risk of nitrate groundwater contamination are:

- **Consolidation to a larger system that can provide safe drinking water to more customers.** Although this option is viable for only a moderate number of systems, consolidation or regionalization of water systems can benefit a larger proportion of the vulnerable population and can help resolve many other long-term problems of small systems.
- **Consolidation of nearby small systems into a larger system** with a larger rate payer base and economies of scale. Even where small systems cannot economically connect to a large system, some opportunities exist to connect some small systems or to jointly manage several small systems to improve their overall financial condition.
- **Ion exchange treatment,** which is usually the most economical community treatment for groundwater contaminated by nitrate.
- **Interim point-of-use treatment or use of bottled water** until a more long-term and sustainable solution can be evaluated and implemented.
- **Blending of contaminated wells,** albeit temporarily if local nitrate contamination is expanding.

Table 13. Influence of nitrate concentration on treatment selection

Practical Nitrate Range	Option	Considerations
10–30% above MCL	blend	Depends on capacity and nitrate level of blending sources.
Up to 2× MCL	ion exchange	Depends on regeneration efficiency and costs of disposal and salt usage. Brine treatment, reuse, and recycling can improve feasibility at higher nitrate levels.
Up to many × MCL	reverse osmosis	Depends on availability of waste discharge options, energy use for pumping, and number of stages. May be more cost-effective than IX for addressing very high nitrate levels.
Up to many × MCL	biological denitrification	Depends on the supply of electron donor and optimal conditions for denitrifiers. Ability to operate in a start-stop mode has not yet been demonstrated in full-scale application; difficult to implement for single well systems. May be more cost-effective than IX for addressing high nitrate levels.

Source: Contact with vendors and environmental engineering consultants; Jensen et al. 2012.

A preliminary analysis was conducted to identify the short-term lowest-cost option for susceptible water systems in the project area to respond to nitrate contamination (Honeycutt et al. 2012). Results from this preliminary analysis, with and without point-of-use treatment for state small water systems, are summarized in Table 15 and Figure 22 (excluding POU). Due to public health and reliability concerns, point-of-use treatment is currently only allowed by CDPH as an interim action for very small water systems (serving <200 connections) facing nitrate pollution. In either case, drilling a new well appears to be the most economical solution for larger systems serving most of the susceptible population. In the long term, expanding nitrate contamination might reduce the viability of this option. If permanently allowed, point-of-use treatment for individual households would be economically preferred for most very small systems. Regionalization by connecting to a nearby larger system is attractive for a substantial minority of systems and about 10% of the susceptible population. The expense of groundwater treatment makes it relatively rare, but it remains important when other options are unavailable. Connection to surface water facilities was generally not found to be economical due to the high cost of surface water treatment facilities.

If expanding nitrate contamination precludes sustainable use of new wells, costs increase greatly for community public water systems to respond to nitrate contamination (Table 16). In this most constrained case, connecting to nearby larger systems (regionalization) is more common,

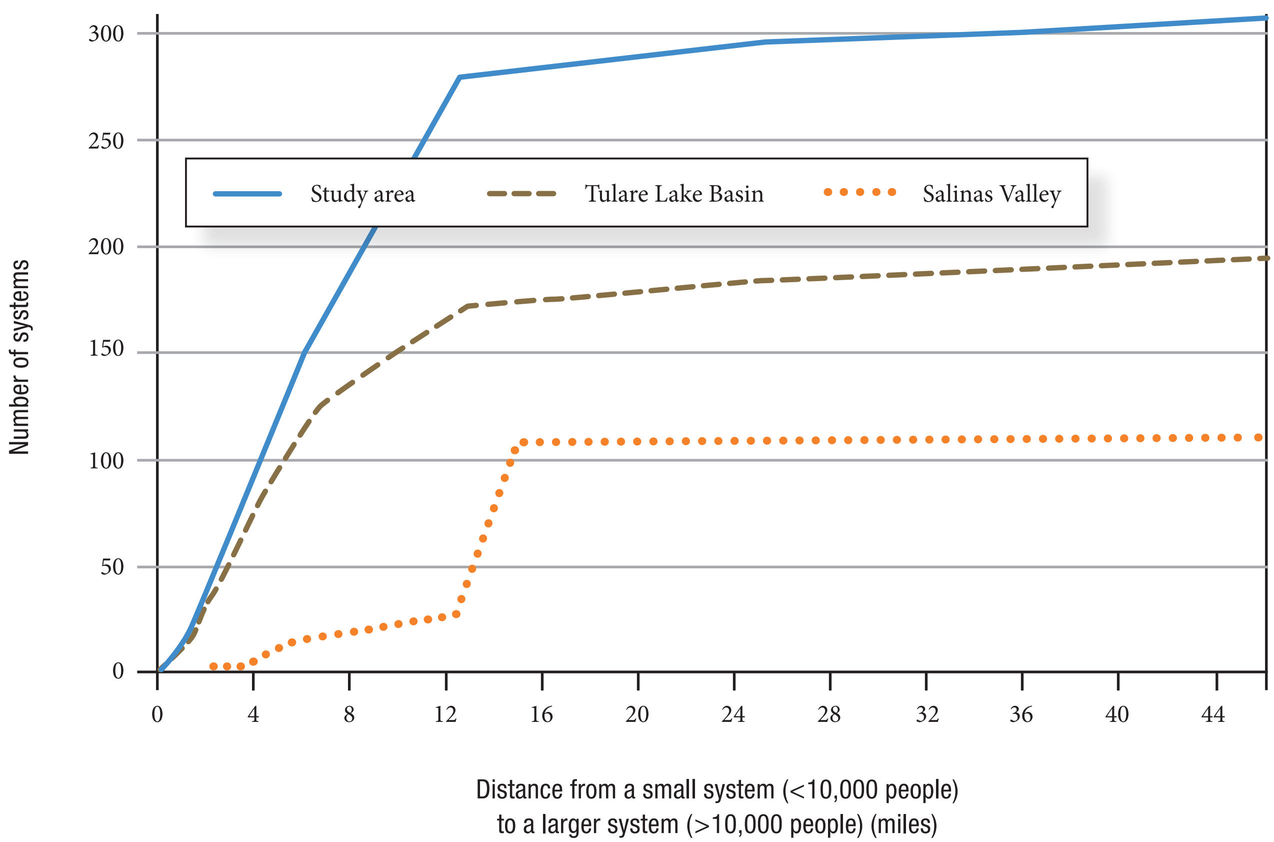


Figure 21. Cumulative distribution of the minimum distance from a small system (<10,000 people) to a larger system (>10,000 people) for the study area. Source: Honeycutt et al. 2012.

groundwater community treatment is common for small systems, and several of the largest systems (serving most of the susceptible population) switch to surface water treatment. The total estimated cost of alternative water supplies for susceptible community water systems more than doubles under this sustainable long-term scenario.

Options for Self-Supplied Households and Local Small Water Systems

Self-supplied and local small water systems have a smaller range of options (see Table 14). Point-of-use treatment is often the least-expensive option. Drilling a new well is sometimes more economical, where water use is greater and future nitrate contamination is less problematic.

Table 14. Safe drinking water option costs for self-supplied household and small community public water systems

Option	Estimated Annual Cost Range ($/year)	
	Self-Supplied Household	Small Water System (1,000 households)
Improve Existing Water Source		
Blending	N/A	$85,000–$150,000
Drill deeper well	$860–$3,300	$80,000–$100,000
Drill a new well	$2,100–$3,100	$40,000–$290,000
Community supply treatment	N/A	$135,000–$1,090,000
Household supply treatment	$250–$360	$223,000
Alternative Supplies		
Piped connection to an existing system	$52,400–$185,500	$59,700–$192,800
Trucked water	$950	$350,000
Bottled water	$1,339	$1.34 M
Relocate Households	$15,090	$15.1 M
Ancillary Activities		
Well water quality testing	$15–$50	N/A
Dual distribution system	$575–$1,580	$260,000–$900,000

Source: Honeycutt et al. 2012.

Table 15. Estimated cost of the lowest-cost short-term alternative water supply option for susceptible community public water systems and state small water systems based on system size and proximity to a larger system

Option	Number of Susceptible Water Systems		Population		Total Cost ($/year)	
	Including POU	Excluding POU	Including POU	Excluding POU	Including POU	Excluding POU
Drill new well	10	63	184,100	191,700	$10,144,000	$14,500,000
POU device for potable use	70	——	10,500	——	$1,320,000	——
Pipeline to a nearby large system (10,000+ system)	5	13	25,300	27,300	$865,000	$1,463,000
Groundwater treatment facility	0	9	0	900	$0	$450,000
Surface water treatment	0	0	0	0	$0	$0
Total	**85**	**85**	**219,900**	**219,900**	**$12,329,000**	**$16,413,000**

Source: Honeycutt et al. 2012.

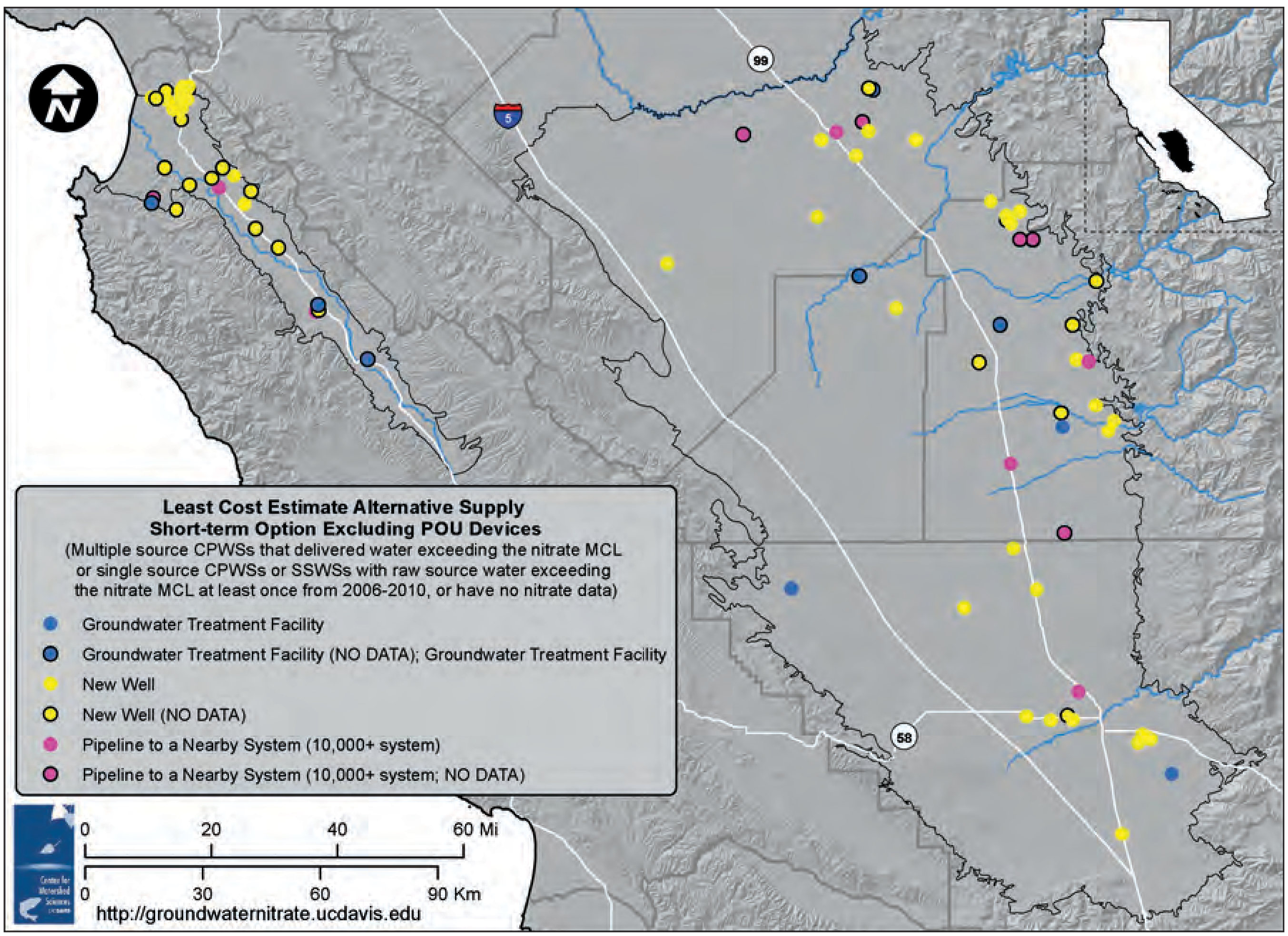


Figure 22. Lowest-cost alternative supply option (excluding POU systems) based on a high estimate of option costs for susceptible community public water systems and state small water systems (multiple source CPWS or SSWSs exceeding the nitrate MCL; or single-source CPWS or SSWSs exceeding the nitrate MCL at least once from 2006–2010; or those having no data). Source: Honeycutt et al. 2012.

4.4 Cost of Providing Safe Drinking Water

Roughly $12 to $17 million per year in additional costs in the near term will be needed to provide safe drinking water for people on community systems in the Tulare Lake Basin and Salinas Valley affected by nitrate contamination of groundwater (see Table 15). These costs are for 85 susceptible systems currently serving roughly 220,000 people. To provide safe drinking water for long-term solutions for these 85 systems will cost roughly $34 million per year if new wells are no longer sufficient. As additional systems become affected by nitrate contamination, these costs could increase.

The annualized additional cost of providing nitrate-compliant drinking water to the estimated 34,000 people (10,000 rural households) using domestic wells or local small water systems that are highly susceptible to current or future nitrate contamination is at least $2.5 million per year for point-of-use treatment for drinking purposes only. These costs could be lower if a manufacturing discount for bulk purchase of POU/POE systems were available. The lowest-cost POU option is used for all domestic well and local small water systems in the study area, estimated for both the short and long term. This does not include the cost of monitoring, public awareness, or regulatory programs to identify and reach out to this currently unregulated and unmonitored population.

The short-term cost to fund alternative water supplies for the highly susceptible nitrate-affected population amounts to $60 to $80 per susceptible person per year, $4 to $5 per irrigated acre per year for the 4 million acres of agriculture in these basins, or $75 to $100 per ton of fertilizer nitrogen (assuming about 200,000 tons of fertilizer nitrogen is applied in the study area). Allowing for only long-term, more viable, and sustainable alternative drinking water solutions for the affected population, the total cost amounts to $142 per susceptible person per year, $9 per irrigated acre per year, or $180 per ton of fertilizer in the long term.

Table 16. Estimated cost of the lowest-cost long-term alternative water supply options for susceptible community public water systems and state small water systems based on system size and proximity to a larger system

Option	Number of Susceptible CPWSs/SSWSs	Population	Total Cost ($/year)
Pipeline to a nearby system (10,000+ system)	29	36,600	$5,592,000
Groundwater treatment facility	51	8,000	$6,344,000
Surface water treatment facility	5	175,300	$21,532,000
Total	**85**	**219,900**	**$33,468,000**

Source: Honeycutt et al. 2012.

5 Policy Options for Nitrate Source Reduction and Funding

This section summarizes a range of policy options for reducing nitrate sources of contamination to groundwater and funding for resolving the problems of nitrate contamination. These options are drawn from the more detailed and extensive examination in Canada et al. (2012). Promising actions on future nitrate source reduction and funding options are discussed in Section 6.

5.1 Nitrate Source Reduction Policy Options

A wide range of policy options are available to reduce nitrate contamination to groundwater over time. We use four criteria for evaluating broad classes of regulatory options: the costs incurred by dischargers to reduce nitrate loading to achieve a nitrate standard (abatement costs), the costs of monitoring and enforcement, the information requirements, and the potential for raising revenues (for funding drinking water actions and other purposes related to nitrate contamination). These results are summarized in Table 17 and further described by Canada et al. (2012).

Specific technology mandates on farmers and agriculture will result in high per-unit costs for reducing nitrate contamination. Farming practices vary tremendously, even within these basins, so specific technology standards would be unlikely to be broadly effective or economical. Less-specific performance standards would provide more flexibility but still do not account for the variation in costs across farms. Nitrate or nitrogen fees or cap-and-trade approaches give farmers more flexibility to respond to required reductions in nitrate loading, thereby reducing the costs of nitrate abatement. If these actions are monitored and enforced based on nitrate leaching rates, much more costly and extensive on-site monitoring would be needed, whereas enforcement and accounting of fertilizer application requirements would be much less burdensome. Reducing nitrate leachate by imposing fees on nitrate or nitrogen has an added advantage of raising funds that may be used to compensate affected drinking water users. A cap-and-trade approach can also raise funds if nitrogen use permits are auctioned.

Hybrid options are also available to regulate nitrate. For nearly 15 years, the Netherlands has used a hybrid approach to manage nitrate (Kruitwagen et al. 2009; Ondersteijn et al. 2002). Under this system, agricultural sources are regulated using a performance standard combined with a fertilizer fee. (see "The Dutch Experience," p. 46). Hybrid regulations might be practical for managing nitrate leachate.

Information disclosure would have dischargers of nitrate or users of nitrogen make such information public. Water systems could also face more stringent water quality consumer reporting rules. Such disclosures should provide some motivation to reduce nitrate discharges.

Table 17. Summary of regulatory options to reduce nitrate contamination to groundwater

Regulatory Option	Abatement Costs	Monitoring and Enforcement Costs	Information Requirements	Revenue Raising
Technology mandate	high	Fertilizer application: low Nitrate leachate: high		no (unless fines)
Performance standard	medium			no (unless fines)
Fee	low			yes
Cap and trade	low			yes (if permits auctioned)
Information disclosure	medium	low	low	no (unless fines)
Liability rules	—	high	high	yes
Payment for water quality	low	low (if payment made to farmers) high (if payment made to state)	high	yes (if payment made to state)
De-designation of beneficial use	low	high	medium	no

Source: Canada et al. 2012.

Liability rules would make nitrate dischargers liable to users of drinking water and other groundwater users for the costs imposed by their discharges. If liability is established in courts, the costs could be quite high and may not necessarily result in much discharge reduction. Porter-Cologne Act Water Code Section 13304 might provide a useful framework.

Having water users or the state pay nitrate dischargers to reduce their dischargers ("payment for water quality") also has high transaction costs, without immediate effect to drinking water quality. But nitrate dischargers might find this an attractive long-term or preventive solution.

De-designating groundwater for drinking water use would shift all drinking water burdens to local water users. This would be administratively and politically awkward, acknowledging a permanent degradation to groundwater quality without compensating drinking water users.

Major Findings: Future Source Reduction Options

1. **Many options exist to regulate nitrate in groundwater, but there is no ideal solution.** The costs of regulatory options vary greatly, and while no option is perfect, some seem preferable to others.

2. **Regulating fertilizer application has lower monitoring and enforcement costs and information requirements than does regulating nitrate leachate, but it may be less effective in achieving nitrate reduction targets**. While the regulation of fertilizer application is easier to implement and enforce than the regulation of nitrate leachate, fertilizer regulation does not guarantee that water quality standards will be met. Due to nonuniform mixing, transport, and dispersion of nitrate in groundwater, it is difficult to quantify the impact of a unit of fertilizer on nitrate contamination of drinking water over time.

3. **Costs to farmers for reducing nitrate contamination can be lower with market-based regulations (fertilizer fees or cap-and-trade programs) than with technology mandates or prescriptive standards because of the additional flexibility farmers have in complying with market-based regulations.** Market-based instruments also encourage the development and adoption of new technologies to reduce fertilizer use, but they may lead to the formation of contamination hot spots.

4. **Well-defined and enforceable regulatory requirements are needed for liability rules to work.** In California, all groundwater is considered to be suitable, or potentially suitable, for municipal or domestic water supply and should be so designated by the Porter-Cologne Section 13304 which gives the California Water Boards authority to force polluters to pay for alternative water supplies for affected users of public water systems and private wells. Legislation might be useful to solidify Regional Board authority to apply this provision broadly.

5.2 Funding Options

Existing funding to address the costs of drinking water actions for communities and systems affected by nitrate contamination appears to be inadequate for many systems and largely requires drinking water users to bear the costs of groundwater contamination by others. The cost of nitrate contamination is felt disproportionately for small water systems (Honeycutt et al. 2012; Canada et al. 2012). Funding is also sparse for monitoring and for broad understanding of groundwater nitrate.

Many state, federal, and local programs exist to help fund local communities responding to nitrate contamination of their groundwater supplies, as discussed in Section 3 and Canada et al. (2012) and summarized in Table 9. Although current programs provide useful resources, they have been insufficient in addressing problems of nitrate groundwater contamination, particularly for smaller and poorer communities, who have less technical, managerial, and financial capacity for safe drinking water infrastructure and who are often ill-equipped for formal funding program applications.

A wide range of options is available to improve funding for drinking water supplies in areas affected by groundwater nitrate contamination, in addition to funding for nitrate source reduction and groundwater remediation activities. These options include state funding options summarized in Table 18 as well as traditional local water utility and tax options for funding water systems. These funding alternatives are addressed in greater depth by Canada et al. (2012). That examination and analysis led to the following findings for state funding and the promising options that are stated in Section 6.1(F).

Major Findings: Future Funding Options

1. **Many options exist to raise funds for safe drinking water and nitrate source reduction actions, but but all require that someone bear the cost, and many are awkward or insufficient.** Water use fees, groundwater pumping fees, bottled water fees, crop fees, and fertilizer fees are a few of the many potential sources for funding safe drinking water and source reduction actions.

2. **Some funding options give polluters a useful price signal.** Fertilizer (or nitrate leachate) fees and auctioned permits induce emitters to reduce fertilizer or nitrate use. Farmers do not pay sales tax on fertilizer in California.

Table 18. Summary of future state funding options

Option	Incentive to Reduce Nitrate	Who Pays	Example
Crop tax	no	producers and consumers of food	State Sales Tax Rate for Soft Drinks: The State of Maryland charges a 6% sales tax for soft drinks.
Fixed fee on drinking water agricultural water	 no no	 drinking water users agricultural users	Federal Communications Commission Universal Service Fee: A fixed fee placed on monthly phone bill to assure universal access to telecommunications for low-income and high-cost rural populations.
Volumetric fee on **drinking water** **agricultural water**	 no low	 drinking water users agricultural users	Gas Public Purpose Program Surcharge: A volumetric fee on gas bills in California to fund assistance programs for low-income gas customers, energy efficiency programs, and public-interest research.
Groundwater pumping fee	medium	agricultural groundwater users	Pajaro Valley Groundwater Pumping Fee: A per-acre-foot charge to secure financing for debt stabilization and to address groundwater overdraft.
Fee on bottled water	no	consumers of bottled water	California Redemption Value: A refundable fee placed on recyclable bottles at the point of sale.
Agricultural property tax	no	agricultural property owners	CA State Property Tax: A statewide ad valorem tax equal to a percentage of the purchase price is collected from all properties in the state, with some exceptions.
Fertilizer tax	high	consumers of fertilizer	Mill Assessment Program: The state imposes a fee of 2.1 cents per dollar on pesticide sales at the point of first sale into the state.
Nitrate leachate tax	highest	nitrate emitters	Duty on Wastewater: In the Netherlands, a tax of approximately $3.60 is imposed on each kilogram of nitrate in wastewater.
Cap and trade with auctioned permits	high/ highest	consumers of fertilizer and nitrate emitters	Title IV of the Clean Air Act Amendments: Established a tradable permit approach to control sulfur dioxide emissions. A small portion of permits sold in an auction.

Source: Canada et al. 2012.

Payment for Ecosystem Services in New York City

Currently, New York City participates in a payment for ecosystem services program for watershed protection. Under the U.S. Safe Drinking Water Act (SDWA), the city was required to meet the state water quality standards by either constructing a water filtration plant at an estimated cost of $6 billion in capital and $300 million in annual operating costs (Postel and Thompson 2005) or implementing a much less expensive watershed protection program. New York successfully requested a waiver from the SDWA filtration requirement and negotiated an agreement with upstream landowners and communities within the Catskill-Delaware watershed to establish a watershed protection plan. In 1997, a memorandum of agreement (MOA) was signed by state and federal officials, environmental organizations, and 70 watershed towns and villages to invest $1.5 billion over ten years to restore and protect the watershed (Postel and Thompson 2005). Program financing comes from bonds issued by the city and increases in residential water bills.

The program's fundamental activities include land acquisition; a program to manage and reduce agricultural runoff; a program for better forestry management; a program for enhanced stream management to reduce erosion and habitat degradation; improvements for wastewater infrastructure in the watershed; construction of an ultraviolet disinfection plant; and new regulation and enforcement of mechanisms to ensure continued water quality protection within the watershed (Postel and Thompson 2004). As of 2004, New York City has put $1 billion into the watershed protection program (Ward 2004). The negotiated partnership creates a watershed that provides high-quality drinking water, provides landowners with additional income, and improves recreational usage for nearby communities.

In this instance, negotiation or payment for ecosystem services led to the provision of safe drinking water at a lower cost than the default water filtration plant. By linking the ecosystem service providers with the beneficiaries, New York City successfully executed a comprehensive watershed protection program that delivers safe drinking water at a relatively low cost. New York City's watershed protection program is an example of a payment for ecosystem services program that guarantees the supply of high-quality drinking water and is financed via residential water bills and city bonds.

6 Promising Solutions

Many options are available to address the problems of drinking water quality, aquifer degradation, and economic costs from nitrate contamination of groundwater and its regulation. Of the many options available, some are more promising than others. But even among these promising options, major policy choices must be made.

6.1 Areas of Promising Action

Addressing groundwater nitrate contamination requires actions in four areas: (a) safe drinking water actions for affected areas, (b) reducing sources of nitrate contamination to groundwater, (c) monitoring and assessment of groundwater and drinking water, and (d) revenues to help fund solutions. Promising actions for legislative and state agency consideration in these areas appear below. Starred (*) actions do not appear to require legislative action, but might benefit from it. All actions are compared in Table 19.

Safe Drinking Water Actions (D)

Safe drinking water actions are the most effective and economical short- and long-term approach to address nitrate contamination problems in the Tulare Lake Basin and Salinas Valley. These actions apply especially to small and self-supplied household water systems, which face the greatest financial and public health problems from nitrate groundwater contamination.

D1: Point-of-Use (POU) Treatment. CDPH reports on how to make economical household and point-of-use treatment for nitrate contamination an available and permanent solution for small water systems.*

D2: Small Water System Task Force. CalEPA and CDPH convene an independently led Task Force on Small Water Systems that would report on problems and solutions of small water and wastewater systems statewide as well as the efficacy of various state, county, and federal programs to aid small water and wastewater systems. Many nitrate contamination problems are symptomatic of the broad problems of small water and wastewater systems.*

D3: Regional Consolidation. CDPH and counties provide more legal, technical, and funding support for preparing consolidation of small water systems with nearby larger systems and creating new, regional safe drinking water solutions for groups of small water systems, where cost-effective.*

D4: Domestic Well Testing. In areas identified as being at risk for nitrate contamination by the California Water Boards, as a public health requirement, CDPH (a) mandates periodic nitrate testing for private domestic wells and local and state small systems and (b) requires disclosure of recent well tests for nitrate contamination on sales of residential property. County health departments also might impose such requirements.

D5: Stable Small System Funds. CDPH receives more stable funding to help support capital and operation and maintenance costs for new, cost-effective, and sustainable safe drinking water solutions, particularly for disadvantaged communities.

Source Reduction Actions (S)

Reducing nitrate loading to groundwater is possible, sometimes at a modest expense. But nitrate source reduction works slowly and cannot effectively restore all affected aquifers to drinking water quality. Within the framework of Porter-Cologne, unless groundwater were to be de-designated as a drinking water source, reduction of nitrate loading to groundwater is required to improve long-term water quality. The following options seem most promising to reduce nitrate loading.

S1: Education and Research. California Department of Food and Agriculture (CDFA), in cooperation with the University of California and other organizations, develops and delivers a comprehensive educational and technical program to help farmers improve efficiency in nitrogen use (including manure) and reduce nitrate loading to groundwater. This could include a groundwater nitrate–focused element for the existing CDFA Fertilizer Research and Education Program (FREP), including "pump-and-fertilize" remediation and improved recharge options for groundwater cleanup.*

Table 19. Likely performance of promising state and agency actions for nitrate groundwater contamination

Action	Safe Drinking Water	Groundwater Degradation	Economic Cost
No Legislation Required			
Safe Drinking Water Actions			
D1: Point-of-Use Treatment Option for Small Systems +	◆◆		low
D2: Small Water Systems Task Force +	◆		low
D3: Regionalization and Consolidation of Small Systems +	◆◆		low
Source Reduction Actions			
S1: Nitrogen/Nitrate Education and Research +		◆◆◆	low–moderate
S2: Nitrogen Accounting Task Force +		◆◆	low
Monitoring and Assessment			
M1: Regional Boards Define Areas at Risk +	◆◆◆	◆◆◆	low
M2: CDPH Monitors At-Risk Population +	◆	◆	low
M3: Implement Nitrogen Use Reporting +		◆◆	low
M4: Groundwater Data Task Force +	◆	◆	low
M5: Groundwater Task Force +	◆	◆	low
Funding			
F1: Nitrogen Fertilizer Mill Fee		◆◆◆	low
F2: Local Compensation Agreements for Water +	◆◆	◆	moderate
New Legislation Required			
D4: Domestic Well Testing *	◆◆		low
D5: Stable Small System Funds	◆		moderate
Non-tax legislation could also strengthen and augment existing authority.			
Fiscal Legislation Required			
Source Reduction			
S3: Fertilizer Excise Fee	◆◆	◆	low
S4: Higher Fertilizer Fee in Areas at Risk	◆	◆	moderate
Funding Options			
F3: Fertilizer Excise Fee	◆◆	◆◆	moderate
F4: Water Use Fee	◆◆	◆◆	moderate

◆ Helpful

◆◆ Effective

◆◆◆ Essential

+ Legislation would strengthen.

* County health departments may have authority; CDPH requires legislation.

S2: Nitrogen Mass Accounting Task Force. CalEPA establishes a Task Force, including CDFA, to explore nitrogen mass balance accounting methods for regulating agricultural land uses in areas at risk for nitrate contamination, and to compare three long-term nitrogen source control approaches: (a) a cap-and-trade system; (b) farm-level nutrient management plans, standards, and penalties; and (c) nitrogen fertilizer fees.*

S3: Fertilizer Excise Fee. Significantly raising the cost of commercial fertilizer through a fee or excise tax would fund safe drinking water actions and monitoring and give further incentive to farmers for reducing nitrate contamination. An equivalent fee or excise tax could be considered for organic fertilizer sources (manure, green waste, wastewater effluent, biosolids, etc.).

S4: Higher Fertilizer Fee in Areas at Risk. Areas declared to be at risk for nitrate contamination might be authorized to maintain a higher set of excise fees on nitrogen fertilizer applications (including synthetic fertilizer, manure, waste effluent, biosolids, and organic amendments), perhaps as part of a local safe drinking water compensation agreement.

Monitoring and Assessment (M)

Monitoring and assessment is needed to better assess the evolving nitrate pollution problem and the effectiveness of safe drinking water and nitrate source loading reduction actions. Such activities should be integrated with other state agricultural, environmental, and land use management, groundwater data, and assessment programs (source loading reduction actions), along with other drinking water, treatment, and wastewater management programs (safe drinking water actions).

M1: Define Areas at Risk. Regional Water Boards designate areas where groundwater sources of drinking water are at risk of being contaminated by nitrate.*

M2: Monitor at-Risk Population. CDPH and the State Water Board, in coordination with DWR and CDFA, issue a report every 5 years to identify populations at risk of contaminated drinking water and to monitor long-term trends of the state's success in providing safe drinking water as a supplement to the California Water Plan Update.*

M3: Learn from Department of Pesticide Regulation Programs. CalEPA and CDFA examine successful DPR data collection, analysis, education, and enforcement programs for lessons in managing nitrogen and other agricultural contaminants, and consider expanding or building upon the existing DPR program to include comprehensive nitrogen use reporting to support nitrate discharge management.*

M4: Groundwater Data Task Force. CalEPA, in coordination with CalNRA and CDPH, convenes an independently led State Groundwater Data Task Force to examine the efficacy of current state and local efforts to collect, maintain, report, and use groundwater data for California's groundwater quality and quantity problems.*

M5: Groundwater Task Force. CalEPA, CalNRA, and CDPH maintain a joint, permanent, and independently led State Groundwater Task Force to periodically assess and coordinate state technical and regulatory groundwater programs in terms of effectiveness at addressing California's groundwater quality and quantity problems. These reports would be incorporated into each California Water Plan Update.*

Funding (F)

Little effective action can occur without funding. Four funding options seem most promising, individually or in combination. State funding from fees on nitrogen or water use, which directly affect nitrate groundwater contamination, seem particularly promising and appropriate.

F1: Mill Fee. Increase the mill assessment rate on nitrogen fertilizer to the full authorized amount (CAL. FAC Code Section 14611). This would raise about $1 million/year statewide and is authorized for fertilizer use research and education.*

F2: Local Compensation Agreements. Regional Water Boards can require and arrange for local compensation of affected drinking water users under Porter-Cologne Section 13304. Strengthening existing authority, the Legislature could require that a Regional Water Board finding that an area is at risk of groundwater nitrate contamination for drinking water be accompanied by a cleanup and abatement order requiring overlying, current sources of nitrate to financially support safe drinking water actions acceptable to the local County Health Department. This might take the form of a local "liability district."*

F3: Fertilizer Excise Fee. Introduce a substantial fee on nitrogen fertilizer sales or use, statewide or regionally, to fund safe drinking water actions, nitrate source load reduction efforts, and nitrate monitoring and assessment programs.

F4: Water Use Fee. A more comprehensive statewide fee on water use could support many beneficial activities. Some of such revenues could fund management and safe drinking water actions in areas affected by nitrate contamination, including short-term emergency drinking water measures for disadvantaged communities.

6.2 Developing an Effective Solution Strategy

Table 19 summarizes the required implementation levels and likely performance of promising actions identified above. Much can be done under existing authority and by existing agencies, although additional legislation could strengthen, augment, and further support these capabilities. While these actions include many helpful and effective solutions, none alone are sufficient to address the problems of groundwater nitrate contamination and the resulting drinking water problems. The most effective results will arise through a synergistic combination of major policy direction, legislation, and appropriate blends of of these identified actions.

Options without Fiscal Legislation

Without fiscal (tax, fee) legislation, there are several options to address drinking water or groundwater degradation, though each has a separate suite of choices. The most essential is having the Water Boards formally declare areas at risk for nitrate contamination. Such a declaration (M1) might entail a series of complementary actions, such as requiring domestic well testing in at-risk areas (D3), monitoring of at-risk populations (M2), and formation of a local compensation agreement or liability district for at-risk areas under Water Code Section 13304 (F2). Perhaps greater education and outreach to farmers in at-risk areas would also occur, along with discharger fees to fund safe drinking water actions to reduce nitrate discharges.

Porter-Cologne Act, Water Code Section 13304, states that "a cleanup and abatement order issued by the State Water Board or a regional Water Board may require the provision of, or payment for, uninterrupted replacement water service, which may include wellhead treatment, to each affected public water supplier or private well owner." This provides authority for the California Water Boards to require landowners contributing to nitrate in groundwater drinking water supplies to fund drinking water actions for affected public water supplies and private wells.

Using this authority, when a Regional Water Board establishes that an area is at risk for nitrate contamination of groundwater, it could simultaneously issue a cleanup and abatement order initiating a process for overlying landowners and contributors of nitrate to groundwater in that area to respond with an area drinking water compensation plan.

This process might involve requiring overlying landowners to support drinking water actions that comply with public health requirements established by the local County Health Department, including:

- an initial date by which groups of overlying landowners would submit a proposed area drinking water compensation plan for actions, implementation, and funding to the County Health Department;
- an intermediate date by which the appropriate Regional Water Board and County Health Department would approve such a plan, or one of their own, for overlying landowners to support drinking water actions; and
- a date by which any overlying landowner not complying with the area drinking water compensation plan would be required to cease and desist applications of nitrogen to overlying land exceeding a standard established by the Regional Water Board to protect drinking water users from nitrate pollution. This condition would apply to all overlying landowners if no alternative local compensation agreement drinking water action plan had been approved.

CDPH could issue suitable guidance to County Health Departments on establishing public health requirements.

County Health Departments would need to be empowered to collect fees from landowners pursuant to a drinking water action plan under a cleanup and abatement order. These fees would include the cost to the County Health Department of overseeing the drinking water action plan. Fees could be collected as part of annual county property tax assessments. This approach would provide a relatively organized and efficient means for landowners contributing nitrate to a contaminated aquifer to help decrease the additional costs incurred by drinking water users from nitrate contamination.

To protect public health, requiring testing of domestic wells in areas declared to be at risk of nitrate contamination seems prudent and in the public interest. Legislation seems needed to require such testing (perhaps periodically or on property sale), although perhaps this can be done by county ordinance or administratively as a requirement to receive compensation under Water Code Section 13304.

Options Requiring Fiscal Legislation

Raising additional revenue to address nitrate issues seems to likely require legislation. The only exception is raising the small mill fee on fertilizer to its full authorized limit, which is approved for funding nitrogen use education and research activities.

Among these funding options, perhaps the most promising is to establish a statewide fee on the sale of nitrogen fertilizers, or a more administratively awkward fee on nitrogen use only in designated drinking water contamination risk areas. Such fees would act as both funding sources for safe drinking water actions and as an incentive to reduce nitrogen use, thereby somewhat reducing nitrate loading to groundwater. Partial rebates on these fees could be arranged for farmers who are involved in local area drinking water compensation plans or who have agreed to enforceable reductions in nitrate loads to groundwater.

6.3 Getting Organized

Many promising options are organizational. The management of nitrate groundwater contamination and its drinking water consequences is currently divided among several state agencies, each with historically derived authorities, purposes, and funding, as summarized in Section 3. In particular, the State and Regional Water Boards have the greatest authority under California's Porter-Cologne Act for groundwater quality. The California Department of Public Health and County Health Departments have authority over drinking water quality and public health. The California Department of Food and Agriculture has the greatest authority over fertilizer management and agricultural activities. The Department of Pesticide Regulation has no authority or direct interest in nitrate problems, but it has a successful, modern, integrated program for pesticide management, which may serve as a model for other forms of contamination, including nitrate. California's Department of Water Resources has overall water planning responsibility for the state, including oversight and funding authority for Integrated Regional Water Management Plans, and the State Water Board regulates water rights. The nitrate issues of the Tulare Lake Basin and Salinas Valley overlap several agencies. As environmental problems evolve beyond the origins of these agencies, there is often a need to evolve and coordinate the actions of different state and local agencies.

Nitrate contamination of groundwater is just one example of groundwater quality (and quantity) issues that many state agencies have in common. Each of the above agencies has its own groundwater monitoring, data, management, and often funding programs for groundwater overall or for individual groundwater quality or quantity concerns. Each of these agencies is facing, or will soon face, a range of similar and related groundwater problems regarding nitrate, pesticides, salts, and groundwater recharge and overdraft quantities.

Informational Actions

To help prepare the state to better address these problems, we propose several informational actions. Many informational actions could be triggered by requiring each of the California Water Boards to declare areas at risk of drinking water contamination from nitrate in groundwater (promising action M1). This finding is purely technical and seems well within the means of the Regional Water Boards, perhaps with some coordination from the State Water Board. A declaration of an area being at risk for nitrate groundwater contamination could also trigger several other informational actions. To protect public health, households and other very small water systems would be required to test drinking water wells for nitrate concentration upon sale and periodically thereafter (D4). Populations depending on groundwater in at-risk areas would also be reported to DWR for inclusion in state water planning efforts (M2). The "area at risk" designation could also serve to prioritize or trigger other funding, fee, education, monitoring, or regulatory actions.

Task Forces

We also propose four independently led task forces consisting of a core of agencies with overlapping interests. Having independent leadership would provide some assurance that each task force views the subject problem from more than just a collection of pre-existing agency perspectives.

- A task force on small water systems would seek to develop a common state policy for the problems of small water and wastewater systems in California. Small systems have inherent problems with higher costs, more precarious finance, and fewer technical and managerial resources, as they lack economies of scale. CDPH has long recognized these problems on the water supply side, but there are likely to be benefits from addressing these local water and wastewater utility problems together.

- A task force on nitrogen mass accounting would explore the technical, economic, and institutional issues of having farms account for nitrogen and nitrate fluxes as a basis for regulation or fees. Currently, such detailed accounting is done for pesticides, air emissions, and dairy nitrogen, and it is being contemplated for salts and irrigation water. Having widespread and relatively detailed accounting for nitrogen would allow for some forms of economic management, such as cap and trade, and could also potentially support various educational and regulatory means of reducing nitrate loads to groundwater. This leads to a larger strategic question of whether the range of environmental emissions from agriculture should be accounted for separately by different agencies, gathered together in a single agency, or coordinated among separate agencies. Having a fragmented accounting system seems likely to increase costs and the regulatory burden, while reducing overall insight and understanding of environmental and agricultural problems. Accounting systems can be costly and time consuming for agencies and nitrogen users to administer.

- Two groundwater task forces are proposed. The first is in regard to groundwater data. A major difficulty in preparing this Report has been the fragmentation of groundwater data within and between agencies, as well as the lack of general access to groundwater data. Groundwater has become such an important issue that most agencies have their own groundwater activities. It is now critical that the state has a coherent and more forward-looking policy and technical capability for the collection and management of groundwater data. This issue seems sufficiently complex to call for a separate groundwater data task force.

- The many state interests and agencies involved with groundwater issues also seem to call for a periodic assessment of how effective these distributed programs are in practically addressing California's groundwater problems. This second independent groundwater task force would periodically review and report on the effectiveness of state groundwater activities to each California Water Plan.

6.4 Dilemmas for State Action

Groundwater nitrate contamination poses several overarching dilemmas and challenges for state policy, which will likely require broader discussions.

Local, statewide, or no compensation for pollution. In practice, the costs of pollution of drinking water sources are often borne by drinking water users. Some aspects of state policy (Water Code Section 13304) allow for fairly direct compensation for such costs. And general state support for water treatment also helps cover such costs. State general funds seem unlikely to be able to provide substantial support in the future, and many local communities, particularly small systems, are unlikely to have financial resources to cover such costs. Can the state establish a reasonable, relatively low-cost means to assess non-point source polluters for the drinking water (and perhaps other) costs entailed?

Degradation of groundwater. Current state law and policy does not allow degradation of groundwater quality to levels above water quality objectives defined in the applicable Basin Plan. However, no technological and institutional strategy has been found to economically reduce all nitrate discharges to levels that prevent further groundwater degradation. More modest approaches to reducing nitrate loads are likely to be economical. However, these more moderate reductions in nitrate loads would typically reduce the rate of groundwater degradation, but they would not always prevent degradation, particularly in the short term. If degradation is practically inevitable for some sources, how should state policy best oversee and regulate degradation?

Policy and policy implementation for environmental effects of land use. Both agriculture and urban land uses now face a host of environmental issues overseen by separate agencies and programs. The environmental causes and effects of nitrate contamination alone, for example, involve a diverse array of state agencies and programs. However, these same land uses also imply environmental impacts via pesticides, salinity, water use, air pollution, surface runoff, and endangered species. Many of these regulated (or potentially regulated) aspects interact environmentally, or their solutions have interactive effects and costs for land management. Is there a more effective and efficient policy approach to managing the environmental effects of land uses than mostly independent agencies and programs for each impact?

7 Conclusions

1. **Nitrate problems will likely worsen for decades.** For more than half a century, nitrate from fertilizer and animal waste have infiltrated into Tulare Lake Basin and Salinas Valley aquifers. Nitrate will spread and increase nitrate concentrations in many areas for decades to come, even if the amount of nitrate loading is significantly reduced. Most nitrate in drinking water wells today was applied to the surface decades ago.

2. **Agricultural fertilizers and animal waste applied to cropland are the two largest regional sources of nitrate in groundwater.** Although discharges from wastewater treatment plants, food processors, and septic tanks also contribute nitrate to groundwater and can be locally important, almost all of the regional groundwater nitrate contamination in the Tulare Lake Basin and Salinas Valley is from agricultural fertilizers and confined animal waste.

3. **Nitrate loading reductions are possible, some at modest cost. Large reductions of nitrate loads to groundwater can come at substantial economic cost.** Farm management is improving, but further improvements are necessary. While some are immediately achievable at modest cost, significant barriers exist, including logistical constraints and inadequate education. The cost of reducing nitrate loads to groundwater can be considerable for large reductions, especially on crops that require a substantial (much greater than 25%) decrease in nitrogen application from today's agronomically accepted, typical rates. Such dramatic reductions in fertilization rates without crop yield improvements can decrease net revenues by possibly several hundred million dollars per year within the study area.

4. **Direct remediation to remove nitrate from large groundwater basins is extremely costly and not technically feasible.** The volume of nitrate-contaminated groundwater is far larger than for urban contamination plumes. Standard pump-and-treat remediation to treat the groundwater underlying the Salinas Valley and Tulare Lake Basin would cost tens of billions of dollars. Instead, "pump-and-fertilize" and improved groundwater recharge management are less-costly long-term alternatives.

5. **Drinking water supply actions, such as blending, treatment, and alternative water supplies, are most cost-effective. Blending will become less available in many cases as nitrate pollution continues to spread.** Regardless of actions taken to reduce long-term nitrate loading to groundwater, many local communities in the Tulare Lake Basin and Salinas Valley will need to blend contaminated groundwater with cleaner water sources, treat contaminated well sources, or develop and employ safe alternative water supplies. Blending will become less available as an option in many cases as nitrate pollution continues to spread. The cost of alternative supplies and treatment for these basins is estimated at roughly $20 million to $36 million per year for the next 20 years or more.

6. **Many small communities cannot afford safe drinking water treatment and supply actions. High fixed costs affect small systems disproportionately.** Many small rural water systems and rural households affected by groundwater nitrate pollution are at or below the poverty level. Treatment and alternative supplies for small systems are more costly, as they lack economies of scale. Adherence to nitrate drinking water safety standards without substantial external funding or access to much less expensive treatment technology will potentially bankrupt many of these small systems and households.

7. **The most promising revenue source is a fee on nitrogen fertilizer use in these basins. A nitrogen fertilizer use fee could compensate affected small communities for mitigation expenses and effects of nitrate pollution. Under Water Code Section 13304, California Water Boards could also mandate that nitrate dischargers pay for alternative safe drinking water supplies.** Either mechanism would provide funds for small communities affected by nitrate pollution, allowing them to develop treatment or alternative water supplies that reduce the cost and effect of nitrate pollution over time.

8. **Inconsistency and inaccessibility of data from multiple sources prevent effective and continuous assessment. A statewide effort is needed to integrate diverse water-related data collection activities by various state and local agencies.** Throughout this study, we often faced insurmountable difficulties in gaining access to data already collected on groundwater and groundwater contamination by numerous local, state, and federal agencies. Inconsistencies in record keeping, labeling, and naming of well records make it difficult to combine information on the same well that exist in different databases or that were collected by different agencies. A statewide effort is needed to integrate diverse water-related data collection activities of various state and local agencies with a wide range of jurisdictions. Comprehensive integration, facilitation of data entry, and creation of clear protocols for providing confidentiality as needed are key characteristics of such an integrated database structure.

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The Tulare Lake Basin and the Salinas Valley, with 2.6 million inhabitants and home to nearly half of California's agricultural production, are the focus of this report. Nearly one in ten people in these two regions are currently at risk for nitrate contamination of their drinking water. Water systems providing water for half of these regions' population have encountered excessive nitrate levels in production wells at least once over the last five years.

An independent team of scientists at The University of California, Davis, was contracted by the State Water Resources Control Board to examine this problem. Working in consultation with an Interagency Task Force representing many state and local agencies, the authors undertake a uniquely broad and comprehensive assessment of the wide spectrum of technical, scientific, management, economic, planning, policy, and regulatory issues related to addressing nitrate in groundwater and drinking water for the Tulare Lake Basin and Salinas Valley.

This report identifies, describes, and quantifies past and current sources of nitrate, details the extent of groundwater nitrate contamination, and provides a comprehensive, up-to-date guide to the many options available to address the problems of drinking water quality, aquifer degradation, and economic costs from nitrate contamination of groundwater and its regulation. The report concludes by outlining promising actions in four key areas: safe drinking water actions for affected areas; reducing sources of nitrate contamination to groundwater; monitoring and assessment of groundwater and drinking water; and revenues to help fund solutions. Even among these promising options, major policy choices must be made. The research compiled in this report provides a foundation for informed discussion among the many stakeholders and the public about these policy choices.

The Center for Watershed Sciences at the University of California, Davis, brings a wide range of experts together to examine California's major water issues and problems. Its activities range from scientific and analytical modeling studies to major works on urgent problems. More about the Center can be found at watershed.ucdavis.edu.

Center for Watershed Sciences
University of California, Davis
http://groundwaternitrate.ucdavis.edu

Exhibit 4

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION

Recommendations for an Updated Conditional Waiver of Waste Discharge Requirements for Irrigated Agricultural Waste Discharges, Pursuant to the California Water Code

Staff Report

Report Proposing a Draft Agricultural Order For Water Board Action

March 2011

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State of California

Linda S. Adams, Secretary
California Environmental Protection Agency

State Water Resources Control Board
http://www.waterboards.ca.gov/

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

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
Water Board	Central Coast Regional Water Quality Control Board
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
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)
MAA	Management Agency Agreement
MCL	maximum contaminant level
MDL	method detection limit
MEP	maximum extent practicable
MP	management practice
MRP	monitoring and reporting program
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
State Water Board	State Water Resources Control Board
SVOC	semi-volatile organic compounds
SWAMP	Surface Water Ambient Monitoring Program
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
Water Code	California Water Code
WDRs	waste discharge requirements
µg/l	micrograms per liter

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EXECUTIVE SUMMARY

Staff recommends that the Central Coast Water Board adopt the updated Conditional Waiver of Waste Discharge Requirements for Irrigated Agricultural Waste Discharges, Draft Order No. R3-2011-0006 (hereafter 2011 Draft Agricultural Order). The 2011 Draft Agricultural Order requires landowners and operators of irrigated agricultural lands to:

1. Minimize discharges of waste and meet, or make progress towards meeting, water quality standards and objectives.
2. Comply with conditions of waste discharge control through verification monitoring and reporting.
3. Provide accountability and transparency for the public on behalf of public resources.

Discharges of waste associated with agricultural discharges (e.g., pesticides, sediment, nutrients) are a major cause of water pollution in the Central Coast region. The water quality impairments are well documented, severe, and widespread. Nearly all beneficial uses of water are affected, and many (not all) agricultural waste discharges continue to contribute to already significantly impaired water quality and impose certain risks and significant costs to public health, drinking water supplies, aquatic life, and valued water resources.

The primary water quality issues associated with irrigated agriculture on the Central Coast Region are:

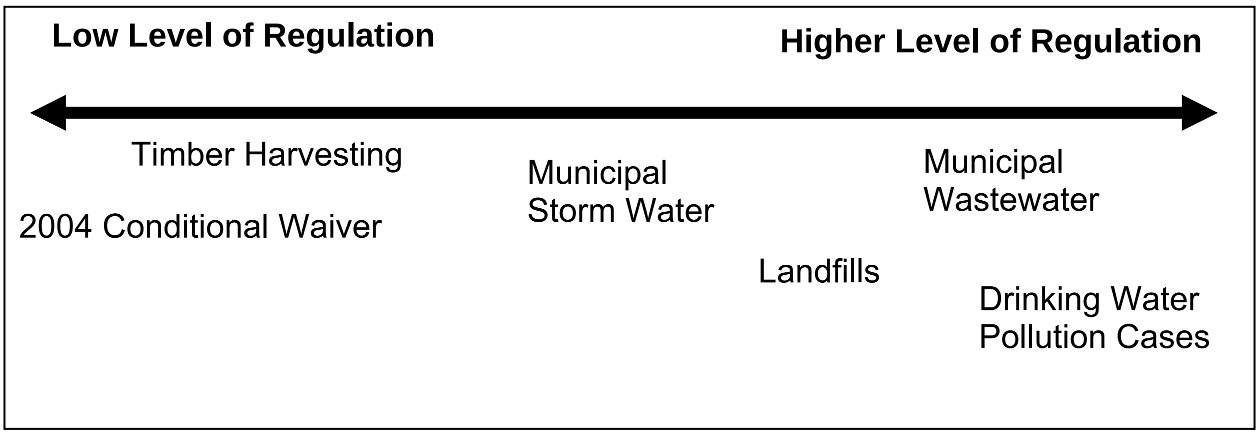
- Thousands of people are drinking water contaminated with unsafe levels of nitrate or are drinking treated or replacement water to avoid drinking contaminated water. The cost to municipalities, communities, families, and individuals for treating drinking water polluted by nitrate is estimated to be in the hundreds of millions of dollars and the health risks for drinking contaminated water are serious-- cancer, Parkinson's disease, thyroid inhibition, diabeters, endocrine disruption and Blue Baby Syndrome. Over 80% of the Central Coast population increasingly relies on groundwater, while pollutant loading also increases. This cycle is not sustainable.

- Large stretches of rivers, creeks, and streams in the Central Coast Region's major watersheds have been severely polluted by toxicity from pesticides, nutrients, and sediment. Agricultural waste discharges have caused some creeks to be found toxic (lethal to aquatic life) every time the site is sampled. As a result, these areas are often completely devoid of the aquatic life essential for a healthy functioning ecosystem. The pollution in some of these areas also creates conditions that are unsafe for recreation and fishing.

Existing and potential water quality impairment from agricultural discharges takes on added significance and urgency, given the impacts on public health, limited sources of drinking water supplies and proximity of the region's agricultural lands to critical habitat for species of concern. If the Water Board and the regulated community do not adequately address the protection of water quality and beneficial uses, the environmental and health affects will become more severe and widespread. Similarly the costs are likely to increase significantly. The environmental, health and cost impacts threaten to significantly affect the future uses of the Central Coast's water resources.

The Water Board adopted a Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands in 2004 (2004 Conditional Waiver or 2004 Agricultural Order), that has been renewed twice. The 2004 Conditional Waiver expires in March 2011. In adopting the 2004 Conditional Waiver, the Water Board found that the discharge of waste from irrigated lands had impaired and polluted the waters of the State and of the United States within the Central Coast Region, impaired the beneficial uses, and caused nuisance. However, the 2004 Conditional Waiver did not try and address nitrate groundwater pollution at that time and did not include conditions consistent with typical orders to control waste discharges from industries or activities affecting water quality so severely. Figure 1 illustrates that the Water Board's current regulation of irrigated agriculture (via the 2004 Conditional Waiver) is very low relative to other programs.

Figure 1. Relative Degree of Water Board Regulation for Various Programs



Since the Water Board adopted the 2004 Conditional Waiver, some dischargers have undoubtedly improved their operations and reduced their pollutant discharges; others may not have improved, and others may have gotten worse. However, the 2004 Conditional Waiver provides no way for the Water Board and the public to <u>directly</u> measure these changes. The only measure is <u>indirect</u>; that is, general watershed-scale monitoring. This type of general monitoring is appropriate to determine if watershed-scale effects are occurring, which in fact has been confirmed; the effects are severe. This type of general monitoring is not appropriate to determine the relative contribution of pollution from individual dischargers, or changes in their discharges. Determining the relative contribution of pollution from individual dischargers is the necessary next step to resolve the severe water quality problems, and is a key component of staff's current proposal, as reflected in the tiering structure and requirements (such as individual monitoring for Tier 3 dischargers).

When staff began the renewal process, we described our intent to directly address the major water quality issues. The Executive Officer's December 2008 letter to stakeholders is available on the Water Board's website:
http://www.swrcb.ca.gov/rwqcb3/water_issues/programs/ag_waivers/docs/ag_order/letter_invitation_12_08.pdf

The Executive Officer's December 2008 letter states:

> *When we bring the Irrigated Ag Order to the Water Board for consideration in 2009, I will propose specific revisions to clarify existing requirements, and new requirements where necessary to directly address and resolve the major water quality issues associated with irrigated agriculture in our Region. These revisions will include time schedules to achieve compliance, milestones, and compliance verification monitoring to address each issue (surface and groundwater pollution, erosion and sedimentation, and habitat degradation). This letter briefly summarizes the main water quality issues we will address, and requests your participation in a series of meetings with us to discuss the Irrigated Ag Order revisions I will propose to the Water Board in July 2009.*

For the current renewal process, staff sought input from a wide group of stakeholders, which has increased the complexity of the process, and understandably has increased the tensions involved in drafting a meaningful Order. As a result of our current process, we now have many more divergent views on how comprehensive the requirements in the renewed Order should be. This is apparent from the many meetings we have attended and the comments submitted. A list of staff's outreach efforts is provided on the Water Board's website: http://www.swrcb.ca.gov/rwqcb3/water_issues/programs/ag_waivers/docs/ag_order/outreach_010711.pdf

During our two-year renewal process for the 2011 Draft Agricultural Order, we developed the requirements and conditions in the Order to address water quality issues, be consistent with Water Board direction, and to be responsive to public input where possible.

Water quality goals for the 2011 Draft Agricultural Order include:

- Eliminate toxic discharges of agricultural pesticides to surface waters and groundwater;
- Reduce nutrient discharges to surface waters to meet nutrient standards;
- Reduce nutrient discharges to groundwater to meet groundwater standards
- Minimize sediment discharges from agricultural lands;
- Protect aquatic habitat;
- Resolve water quality impairments associated with irrigated agriculture;
- Comply with minimum statutory requirements; and
- Establish milestones, targets, and schedules for achieving water quality standards and protecting beneficial uses.
- Establish transparent discharger monitoring and reporting to verify compliance with water quality standards.

Staff also identified the following key concepts as important to stakeholders and Water Board members from review of stakeholder and Board member input:

- Prioritize based on water quality affects and make protection of human health and drinking water the highest priority;
- "One size does not fit all." Require more of those discharging the most, creating the greatest affects, or most threatening water quality;
- Provide reasonable timeframes to control waste discharges and meet water quality goals;
- Require reasonable amount of implementation, monitoring and reporting requirements;

- Allow dischargers flexibility to comply with requirements based on uniqueness of individual operations.

With respect to protecting human health, staff considers this our top priority. The threat to rural homeowners from nitrates in domestic wells is the most important and challenging issue the Water Board and stakeholders are facing. As part of our outreach efforts, staff continues to work on informing other agencies about the severe threat to drinking water supplies. The Executive Officer's June 23, 2010 letter to public health agencies is posted on the Water Board's website:
http://www.swrcb.ca.gov/rwqcb3/NO3_letter_to_PHOs.pdf

The letter includes the following statement:

Section 116270 of the California Health and Safety Code states:

Every citizen of California has the right to pure and safe drinking water.

The 2011 Draft Agricultural Order reflects this priority by including groundwater monitoring and data submittal for all dischargers. Separate from the Agriculture Order, staff is also investigating groundwater well contamination in high risk areas for follow-up actions.

Central Coast Water Board Staff Considered Options and Alternatives

Staff considered a wide range of options based on staff research and input from stakeholders. Staff specifically considered alternatives submitted by interested persons by April 1, 2010. These alternatives included a range of conditions that scaled from low level of regulation, as discussed above, to higher level of regulation. Conditions in the alternative from OSR Enterprises and from the California Farm Bureau Federation (and other agricultural representatives) included relatively low levels of regulation. The alternative from the Environmental Defense Center (and other environmental organizations) was very similar to staff's February 1, 2010 Preliminary Draft Agricultural Order and included relatively higher levels of regulation. Staff considered these alternatives in preparing the Draft 2011 Agricultural Order distributed for public comment on November 19, 2010. The Draft 2011 Agricultural Order and its tiering structure reflect the range of alternatives submitted.

Staff further considered the Draft Central Coast Agriculture's Alternative Proposal for the Regulation of Discharges from Irrigated Agricultural Lands submitted by the California Farm Bureau Federation on behalf of seven County Farm Bureaus and numerous additional entities on December 3, 2010 (hereafter called the Farm Bureau Proposal).

Staff found that this Farm Bureau Proposal represents does not comply with basic statutory requirements and does not include requirements that will adequately protect water quality given the severity and magnitude of pollutant loading and water quality problems. However, there are elements of the Farm Bureau Proposal that may be effective, and staff incorporated those elements in its recommendation to the Water Board.

Specifically, staff identified the following limitations in the Farm Bureau Proposal:

- Monitoring:

- Does not require monitoring that measures the effectiveness of on-farm management practices or pollutant load reduction;
    - All individual farm or operation data and information to be kept confidential;
    - Does not require individual or operation-level monitoring, but indicates it is optional for all growers, even high risk;
- Milestones and Timeframes:
    - Milestones indicate very limited progress towards meeting legal water quality standards, and many waterbodies will still exceed most legal water quality standards;
    - Long timeframes for very limited progress toward surface water quality milestones (4-10 years versus 2-3 years in Draft Ag Order);
    - No milestones or timeframes for groundwater loading or groundwater quality conditions;
- Reporting:
    - Does not include individual or farm or operation-level water quality sampling;
    - Management practice reporting includes results of surveys indicating if and which practices used, but not if effective at preventing or reducing pollution loading;
    - Includes aggregated information reporting for implementation actions (e.g. results for group of operations in a sub-watershed);
    - Content of aggregated reports unspecified (e.g. data will be collected during audits which will result in "points" based on unspecified criteria);
- Inconsistent with Plans and Policies:
    - Does not include measures of progress or achievement of legal water quality standards;
    - Does not include required measures of effectiveness of management practices;
    - Limits the Board's authority and discretion to enforce when the Board finds or measures discharges of wastes or exceedances of water quality standards by defining compliance with the "waiver" as implementation of farm water quality practices;
- Enforceability
    - The Proposal is not enforceable with respect to individual discharges of waste due the lack of specific monitoring and reporting, and the way coalitions would be set up.

Staff also identified the following benefits or improvements in the Farm Bureau Proposal:

- Contains implementation of management practices that address pollutant loading from irrigation, pesticides, sediment, and fertilizer;
- Contains surveys, audits and coalitions to assist growers to adapt and improve operations to improve water quality;
- Prioritizes operations growing crops with high potential to discharge nitrogen to surface and groundwaters (using same criteria as November 19, 2010 Draft Agricultural Order).

Staff integrated suggestions from all these alternatives where appropriate and legal in preparing this recommendation.

Central Coast Water Board Staff Recommendation

The 2011 Draft Agricultural Order groups farm operations, or dischargers, into three tiers, each tier distinguished by four criteria that indicate threat to water quality:

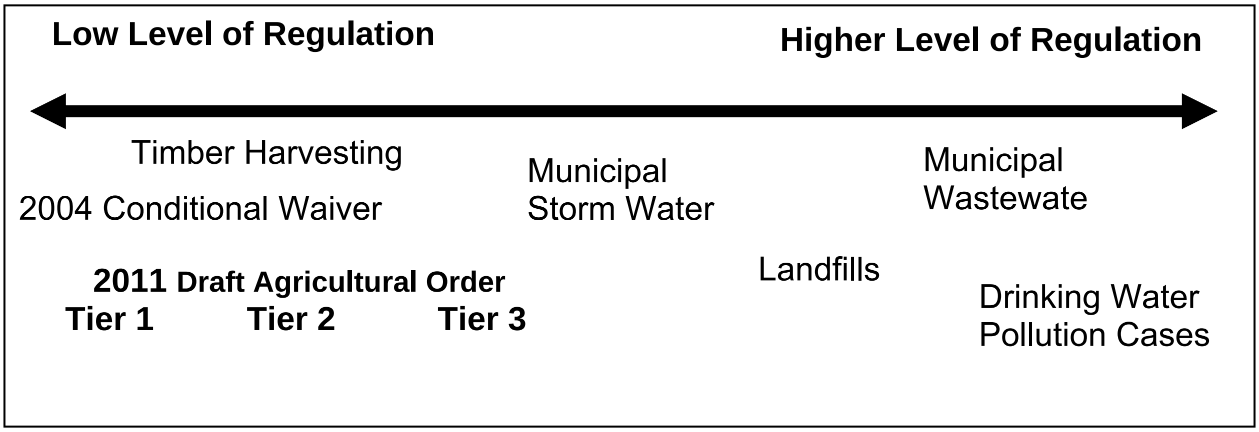
1. size of farm operation,
2. proximity to an impaired watercourse or public water system well,
3. use of chemicals of concern, and
4. type of crops grown.

These tiering criteria were selected because they provide good indicators of threat to water quality from individual operations. The Water Board uses similar criteria, based on threat to water quality, in most other programs; it is simply a water quality prioritization approach. These criteria account for surface and ground water quality conditions in the Central Coast Region, can be determined efficiently by agricultural operators and the Water Board by simple surveys of agricultural operations, and they provide a reasonable approach for scaling regulatory requirements according to actual or potential effects of waste discharges on water quality. Owners/operators do not have to collect additional data or conduct complicated or expensive site evaluations to determine which tier applies to their operations. Water Board staff can quickly verify which operations are in which tier based on recent enrollment information submitted electronically. Finally, the tiering system proposed provides for an owner or operator of agricultural lands enrolling in the Order to present additional information to justify a more appropriate tier for their operations if warranted.

2004 requirements compared to 2011 requirements: Staff found that in a general comparison with the existing 2004 Conditional Waiver, the 2011 Draft Agricultural Order Tier **1 requirements are fewer** than the requirements in the existing 2004 Conditional Waiver. **Tier 2 requirements are comparable to the 2004 Conditional Waiver, with a few additional reporting requirements** to better indicate effectiveness of management practices and reduction in pollutant loading. **Tier 3 requirements are greater** than the requirements in the 2004 Conditional Waiver, as shown in Figure 2.

Staff included this tiering structure because it provides scaled, reasonable levels of conditions and reporting appropriate to threat to water quality. Some operations present a relatively low threat to water quality, while other large operations located close to impaired water bodies or drinking water wells pose a much higher risk.

Figure 2: Relative Degree of Regulation between the 2011 Draft Agricultural Order and Other Programs



This tiering structure places a much lower burden on small family farms (likely to be in Tier 1). There are about 1200 farmers in Tier 1. Staff will work with this group to make reporting requirements as easy as possible to help maintain small farms on the Central Coast. Staff's priority focus in implementing the Order will be on Tier 2 and Tier 3, with Tier 3 the highest priority.

With respect to the other key concepts identified by the Water Board and stakeholders, the 2011 Draft Agricultural Order includes reasonable timeframes, reporting, and flexibility, all relative to the threat to water quality.

The 2011 Draft Agricultural Order proposes the following implementation and reporting requirements:

- Implement pesticide management practices to reduce toxicity in waste discharges so receiving waterbodies meet water quality standards;
- Implement nutrient management practices to eliminate or minimize nutrient and salt in waste discharges to surface water so receiving waterbodies meet water quality standards;
- Implement nutrient management practices to minimize fertilizer and nitrate loading to groundwater to meet nitrate loading targets;
- Install and properly maintain back flow prevention devices for wells or pumps that apply fertilizers, pesticides, fumigants or other chemicals through an irrigation system;
- Implement erosion control and sediment management practices to reduce sediment in waste discharges so receiving water bodies meet water quality standards;
- Protect and manage existing aquatic habitat to prevent discharge of waste to waters of the State and protect the beneficial uses of these waters;
- Implement stormwater runoff and quality management practices;
- Develop, implement, and annually-update Farm Water Quality Management Plans;

- Submit an Annual Compliance Form electronically (for higher threat dischargers) that includes individual discharge monitoring results, nitrate loading risk evaluation and, if nitrate loading risk is high, report total nitrogen applied, irrigation and nutrient management plan, verification of irrigation and nutrient management plan effectiveness;
- Submit a water quality buffer plan (for higher threat dischargers), if operations contain or are adjacent to a waterbody identified on the Clean Water Act section 303(d) List of Impaired Waterbodies as impaired for temperature or turbidity.

The Draft Monitoring and Reporting Program (Draft MRP) includes receiving water monitoring, individual surface water discharge monitoring, individual groundwater sampling, and individual riparian and wetland photo-monitoring.

The Draft MRP recommends that all dischargers in Tier 1, the lowest Tier, conduct the following monitoring:

- Receiving water monitoring- monthly and in cooperation with other dischargers, unless a discharger elects to do this individually (similar to the existing MRP)
- Groundwater sampling- two times in one year during the five years of the Draft Agricultural Order.

The Draft MRP recommends that all dischargers in Tier 2 conduct the following monitoring:

- Receiving water monitoring- same as above for Tier 1
- Groundwater sampling- same as above for Tier 1
- Individual riparian and wetland photo-monitoring- once every three years and only for operations that contain or are adjacent to a waterbody impaired for temperature, turbidity, or sediment

The Draft MRP recommends that all dischargers in Tier 3, conduct the following monitoring

- Receiving water monitoring- same as above for Tiers 1 and 2
- Groundwater sampling- quarterly for one year
- Individual riparian and wetland photo-monitoring- same as above for Tier 2
- Individual surface water discharge monitoring- four times each year for operations greater than 5000 acres and two times each year for operations between 1000 and 5000 acres for these parameters.
    - Discharge Flow measured or calculated in gallons per day;
    - Field Parameters (Temp, pH, EC);
    - Clarity measure turbidity NTUs;
    - Nutrients (Nitrate and Ammonia) concentration measured mg/L;
    - Pesticides (chlorpyrifos and/or diazinon);
    - Toxicity

Other Options Considered

In addition to considering the alternatives submitted by various stakeholders, staff also considered many other options, which are discussed in Appendix D. These options include other regulatory mechanisms, such as Waste Discharger Requirements, to effectively regulate this category of dischargers.

Recommendation

Staff recommends that the Central Coast Water Board adopt the 2011 Draft Agricultural Order, which is the updated Conditional Waiver of Waste Discharge Requirements for Irrigated Agricultural Waste Discharges, Draft Order No. R3- 2011-0006. The 2011 Draft Agricultural Order will require landowners and operators of irrigated agricultural lands to 1) control discharges of waste that affect water quality, in a timely manner, in order to meet, or make progress towards meeting, water quality standards and objectives, 2) comply with conditions of waste discharge control through verification monitoring and reporting, and 3) provide accountability and transparency for the public on behalf of public resources.

Adoption of the Draft Agricultural Order will insure healthier water quality conditions that provide people with safe drinking water and fish and other aquatic organisms with safe habitats in their streams and estuaries.

1. INTRODUCTION

The Water Board currently regulates waste discharges from irrigated lands with a Conditional Waiver of Waste Discharge Requirements (Order No. R3-2010-0040, hereafter referred to as the 2004 Conditional Waiver) that expires in March 2011. The Water Board began a process in December 2008, to consider renewing the 2004 Conditional Waiver, including revising and adding conditions to more effectively reduce or eliminate discharges of waste associated with irrigated agriculture in the Central Coast Region (toxicity, pesticides, nutrients, sediment, affects on drinking water, degradation of aquatic habitat).

There are numerous and varying irrigated agricultural operations within the Central Coast Region that have varying degrees of affect on water quality. As indicated in a December 2008 letter to stakeholders, to directly address and resolve the major water quality issues associated with irrigated agricultural discharges in the Central Coast region, Water Board staff (staff) is recommending a revised Order that includes the following:

- Clear articulation of water quality standards to ensure consistency with applicable Water Board plans and policies;
- Specific conditions to address water quality impairments;
- Milestones to measure progress;
- Time schedules to achieve compliance;
- Monitoring and reporting to verify compliance;

This report (1) summarizes the information staff have considered in the development of a renewed Order, (2) describes the range of regulatory options considered, and (3) provides staff's recommendations for a revised Draft Agricultural Order.

What is the Central Coast Water Board's regulatory role?

The Central Coast Water Board has the statutory responsibility to protect water quality and beneficial uses such as drinking water and aquatic life habitat. Any Order adopted by the Water Board must be consistent with the California Water Code (Water Code) and Water Board plans and policies, including the Water Quality Control Plan for the Central Coast Region (Basin Plan) (Cal. Wat. Code § 13269). The Water Board regulates discharges of waste to the region's surface water and groundwater to protect the beneficial uses of the water. In some cases, such as the discharge of nitrate to groundwater, the Water Board is the principle state agency with regulatory responsibility for coordination and control of water quality (Cal. Wat. Code §13001).

Pursuant to the Porter-Cologne Water Quality Control Act (Wat. Code Div. 7), the Water Board is required to regulate discharges of waste that could affect the quality of waters of the state. It can impose in orders, prohibitions on types of waste or location of discharges, requirements for discharging waste, and conditions on discharges of waste. The Water Board enforces violations of the prohibitions and requirements in these Orders. The Water Board also develops water quality standards and implements plans and programs. These activities are conducted to best protect the State's waters, recognizing the local differences in climate, topography, geology and hydrology.

The 2004 Conditional Waiver expires in March 2011. The Water Board will consider renewing the 2004 Conditional Waiver, including revised and new conditions to assure protection of waters of the state within the Region.

One of the Water Board's highest priorities is to ensure that agricultural waste discharges do not continue to impair Central Coast communities' and residents' access to safe and reliable drinking water. This proposed Draft Agricultural Order prioritizes those agricultural operations and areas of the Central Coast Region already known to have, or be at great risk for, severe water quality pollution. The proposed Draft Agricultural Order would establish a known and reasonable time schedule, with clear and direct methods of verifying compliance and monitoring progress over time. The proposed Draft Agricultural Order must enable the regulated community and stakeholders to understand when Dischargers are in compliance with requirements and successfully reducing their contribution to the water quality problems and maintaining adequate levels of water quality protection.

What is the issue?

Agricultural waste discharges are a major cause of water pollution in the Central Coast region. The water quality impairments are well documented, severe, and widespread. Nearly all beneficial uses of water are affected, and agricultural waste discharges continue to contribute to already significantly impaired water quality and impose certain risk and significant costs to public health, drinking water supplies, aquatic life, and valued water resources.

The primary water quality issues associated with irrigated agriculture on the Central Coast are:

- Thousands of people are drinking water contaminated with unsafe levels of nitrate or are drinking treated or replacement water to avoid drinking contaminated water. The cost to municipalities, communities, families, and individuals for treating drinking water polluted by nitrate is estimated to be in the hundreds of millions of dollars;

- Large stretches of rivers, creeks, and streams in the Central Coast region's major watersheds have been severely polluted by toxicity from pesticides, nutrients, and sediment. Agricultural waste discharges have caused some creeks to be found toxic (lethal to aquatic life) almost every time the site is sampled (e.g., 4 times each year sampled for five years). As a result, these areas are often completely devoid of the aquatic life essential for a healthy functioning ecosystem. The pollution in these areas also creates conditions that are unsafe for recreation and fishing.

The Water Board has the authority and responsibility to protect water quality and beneficial uses. The regulated community has the responsibility to comply with the Water Code. Failure to do so could result in costs and other affects on water quality that are likely to increase significantly and severely limit the future of the Central Coast's water resources.

Why is the issue important?

Millions of Central Coast residents depend on groundwater for nearly all their drinking water from both deep municipal supply wells and shallow domestic wells. In addition, the Central Coast Region's coastal and inland water resources are unique, special, and in some areas still of relatively high quality. The Region supports some of the most significant biodiversity of any temperate region in the world and is home to many sensitive natural habitats and species of special concern. Agricultural waste discharges continue to severely affect and threaten these resources and beneficial uses.

At the same time, the agricultural industry in the Central Coast Region is also one of the most productive and profitable agricultural regions in the nation, reflecting a gross production value of more than six billion dollars in 2008, contributing 14 percent of California's agricultural economy. For example, agriculture in Monterey County supplies 80 percent of the nation's lettuce and nearly the same percentage of artichokes and sustains an economy of 3.4 billion dollars.[1]

Resolving agricultural water quality issues will greatly benefit public health, present and future drinking water supplies, aquatic life, recreational, aesthetic and other beneficial uses. Resolving agricultural water quality issues will also require changes in farming practices, will impose increasing costs to individual farmers and the agricultural industry at a time of competing demands on farm income, regulatory compliance efforts, and food safety challenges, and may impact the local economy. No industry or individual has a legal right to pollute and degrade water quality, while everyone has a legal right to clean water. Similar to all other Dischargers, the agricultural community is responsible for identifying, preventing and resolving pollution caused by irrigated agriculture and complying with water quality requirements.

Healthy watersheds and a sustainable agricultural economy can coexist. Protecting water quality and the environment while protecting agricultural benefits and interests will require change, and may shift who bears the costs and benefits of water quality protection. Continuing to operate in a mode that causes constant or increasingly severe receiving water problems is not sustainable.

2. STAFF RECOMMENDATION

Staff recommends that the Water Board adopt the 2011 Draft Agricultural Order to control waste discharges from irrigated lands. The rationale for this recommendation is summarized below and further explained in Sections 4 and 5 and the Appendices of this report.

The 2011 Draft Agricultural Order regulates discharges of waste from irrigated lands to ensure that such dischargers are not causing or contributing to exceedances of any Regional, State, or Federal numeric or narrative water quality standard, such that all beneficial uses are protected. The 2011 Draft Agricultural Order directly addresses agricultural waste discharges – especially contaminated irrigation runoff and percolation to groundwater causing toxicity, unsafe levels of nitrate, unsafe levels of pesticides, and excessive sediment in surface waters and/or groundwater. The 2011 Draft Agricultural Order also focuses on those areas of the Central Coast Region already known to have, or at great risk for, severe water quality impairment. In addition, the 2011 Draft Agricultural Order requires all dischargers to effectively implement management practices (related to irrigation, nutrient, pesticide and sediment management) that

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[1] Salinas Valley Chamber of Commerce http://atlantabrains.com/ag_industry.asp

will most likely yield the greatest amount of water quality protection. The 2011 Draft Agricultural Order includes more stringent conditions to eliminate or minimize the most severe agricultural waste discharges and includes clear and direct methods and indicators for verifying compliance and monitoring progress over time. The proposed Draft Agricultural Order also includes reasonable time schedules to eliminate or minimize degradation from all agricultural waste discharges.

Staff recognizes that the pollution caused by irrigated agriculture is significant and will not be resolved in a short time frame. Staff's priority in the short term is to take deliberate steps towards water quality improvement and eliminate or minimize agricultural waste discharges that load additional pollutants to water bodies and groundwater basins that are already polluted or at high risk of pollution.

Given the scale and severity of pollution in agricultural areas and the affects on beneficial uses, including drinking water sources, staff recommends more stringent regulation, more monitoring and more reporting so discharger data and information is more accessible to the greater public and holds individual dischargers more accountable for reducing pollution loading from individual farm operations. Additionally, Water Board implementation of this 2011 Draft Agricultural Order and compliance by dischargers will be consistent with the State Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program (NPS Policy), specifically by providing publicly-accessible data and information, and creating greater individual discharger accountability for measurable and trackable pollution reduction. Finally, the 2011 Draft Agricultural Order will insure progress towards or achievement of water quality standards through increased control of waste discharges to waters of the State and United States.

The range of stringency of Water Board regulation varies considerably, depending on the severity of the problem. At one end of the range are individual waste discharge requirements, which impose limits on specific pollutants in the waste discharge. For example, industrial wastewater treatment facilities have strict limits on the amounts of toxic pollutants they can discharge. At the other end of the range, for waste discharges with a low threat to water quality, the Water Board may only require use of management practices. The level of regulation proposed in the 2011 Draft Agricultural Order is near the middle of this range. Staff is not advocating an immediate shift to the most stringent level of regulation, because, as mentioned above, pollution caused by irrigated agriculture will not be resolved quickly, and because increases in technology and infrastructure will take some time.

Implementation of the Agricultural Order

As with all Orders issued by the Water Board, this Draft Agricultural Order sets the framework and authority for staff to use a routine progressive enforcement strategy, consistent with the State's Nonpoint Source Pollution Control and Enforcement Policies. The Draft Agricultural Order contains several general prohibitions and conditions. It also has some conditions with explicit timeframes for specific indicators or milestones to indicate compliance. Generally, the Draft Agricultural Order requires dischargers to effectively reduce pollutant loading and waste discharges to surface and groundwater from the irrigated agricultural operations under their control or ownership.

Dischargers are legally obligated to comply with the prohibitions and conditions immediately. However, the 2011 Draft Agricultural Order, in Finding 2, also acknowledges that it will take time for pollution sources to be controlled enough to meet water quality standards in receiving water.

In practice, the Water Board can withhold enforcement for failure to meet individual general conditions immediately, if dischargers are meeting conditions of the Draft Agricultural Order regarding implementation, monitoring and reporting. To evaluate an enforcement recommendation to the Board for failure to meet one or several conditions of the Order, staff will consider documentation of data and information related to groundwater sampling, individual discharge monitoring, implementation of management practices, treatment or control measures, or changes in farming practices to achieve compliance with this Order, and compliance history. For example, one way a discharger can demonstrate compliance with a timeframe and milestone is to show that irrigation runoff from an individual operation is meeting water quality standards. However, a discharger can also show compliance with timeframes and milestones by showing improvement in the other indicators or parameters required to be measured or observed at the place where a specific condition or action is required by the Order (See content of the Annual Compliance Document in the Monitoring and Reporting Program in Attachment B). Many dischargers (such as those enrolled in stormwater discharge permits) and grant-funded project directors are evaluating or have evaluated effectiveness of their water quality improvement practices using measurements, estimations, or simple modeling of pollution load reduction. This Draft Agricultural Order will impose similar and routine regulatory requirements and compliance evaluations on agricultural dischargers as currently exists for municipal and other industrial wastewater dischargers and stormwater dischargers.

The 2011 Draft Agricultural Order is consistent with legal requirements and goals and criteria established by the Water Board for developing a revised or new Order (see Appendix I.). The 2011 Draft Agricultural Order also incorporates all comments and suggestions made by Water Board members during public workshops (see Sections 4.B. and 4.C.). Staff incorporated all of the Water Board members' suggestions in the Draft Ag Order by:

- Building on the Preliminary Draft Agricultural Order distributed on February 1, 2010;
- Making human health protection the highest priority for waste discharge control;
- Including short term actions that will immediately improve and protect drinking water;
- Targeting the most impaired areas;
- Prioritizing operations with highest risk for their waste discharge to affect water quality;
- Using prioritization criteria that provide integration of water quality impairments (their locations, severity and human health risks) with characteristics of operations that inform where and which operation are highest risk for discharging waste that affects water quality (e.g., size, crop types, fertilizer and pesticide use), thereby increasing efficiency ;
- Including more implementation, monitoring and reporting requirements for the high risk operations;
- Including specific timeframes to reduce waste discharge and pollutant loading from high risk operations;
- Including targeted monitoring and reporting to collect best information to determine reductions in waste discharges, reductions in pollutant loading, and water quality improvements in receiving surface and groundwater;
- Including reduced monitoring and reporting for operations with low risk discharges;
- Allowing proprietary information to remain in Farm Plans and only requiring reporting of information that indicates effectiveness of waste discharge control practices and reductions in pollutant loads;
- Streamlining reporting information and improving information management systems and tools so staff can more efficiently and effectively evaluate data and information so limited staff resources are focused on highest priority compliance assistance and enforcement activities;

In developing this recommendation, staff also considered and compared several options or alternatives to this 2011 Draft Agricultural Order (see Section 3.C., 4.B., 4.C., and Appendix D). These included the existing 2004 Conditional Waiver, the Preliminary Draft Agricultural Order distributed February 1, 2010, three alternatives submitted April 1, 2010- one from the California Farm Bureau Federation and other agricultural groups, one from OSR Enterprises, Inc. and one from the Monterey Coastkeeper and other environmental groups, and another alternative submitted December 3, 2010 by the California Farm Bureau Federation. Staff also considered several different options for implementation, monitoring and reporting requirements within the Draft Agricultural Order (see Section 3.C and Appendix D).

Staff's recommendation is responsive to the comments and suggestions from interested parties representing regulated agriculturalists or industry representatives, environmental protection organizations, environmental justice advocates for clean drinking water for rural residents, and several other members of the public (see Section 4.B., 4.C., 4.D., and Appendix E).

Finally, staff developed this proposed 2011 Draft Agricultural Order to address the documented severe and widespread water quality problems in the Central Coast Region, predominately unsafe levels of nitrate in groundwater used for drinking water and toxicity decimating or impairing communities of aquatic organisms (see Section 4.D. and Appendix G).

Staff recommends that the Central Coast Water Board adopt the 2011 Draft Agricultural Order, which is the updated Conditional Waiver of Waste Discharge Requirements for Irrigated Agricultural Waste Discharges, Draft Order No. R3- 2011-0006. The 2011 Draft Agricultural Order will require landowners and operators of irrigated agricultural lands to 1) control discharges of waste that affect water quality, in a timely manner, in order to meet, or make progress towards meeting, water quality standards and objectives, 2) comply with conditions of waste discharge control through verification monitoring and reporting, and 3) provide accountability and transparency for the public on behalf of public resources.

3. PROPOSED DRAFT AGRICULTURAL ORDER

A. Summary of Proposed Draft Conditions, Monitoring and Reporting Requirements

The Draft Agricultural Order establishes three tiers of conditions based on threat to water quality. The Draft Agricultural Order requires Dischargers to comply with conditions for the "tier" that applies to their operation. The tiers are based on four criteria that indicate threat to water quality: size of farm operation, proximity to an impaired surface waterbody or public water system well, use of chemicals of concern, and type of crops grown. Dischargers with the highest threat have the greatest amount of waste discharge control requirements, monitoring and reporting. Conversely, dischargers with the lowest threat have the least amount of discharger control requirements, individual monitoring and reporting. Staff estimates that approximately 377 (13%) operations covering 54% of the total irrigated crop acres in the Central Coast Region will fall into Tier 3 (highest threat); 1,367 (46%) operations covering 25% of total irrigated crop acres will fall into Tier 2 (moderate threat); 1,256 (42%) operations covering 21% of total acres will fall into Tier 1. Tiers and the rationale for the criteria are discussed further in Section 3.C.

Dischargers must comply with the conditions and monitoring and reporting requirements for their tier. The conditions in the Draft Agricultural Order are summarized in Table 1 below.

Table 1. Summary of Required Conditions (Compliance dates are shown in Tables 3 and 4)

All Dischargers must:
Comply with applicable water quality standards for pesticide, toxicity, nutrient, sediment, turbidity, or temperature as defined in Attachment A, protect the beneficial uses of waters of the State and prevent nuisance.
Have properly maintained back flow prevention devices installed at the well or pump to prevent pollution of groundwater or surface water.
Properly destroy all abandoned groundwater wells, exploration holes or test holes.
Implement proper handling, storage, disposal and management of pesticides, fertilizer, and other chemicals to prevent or control the discharge of waste to waters of the State.
Implement source control or treatment management practices to prevent erosion, reduce stormwater runoff quantity and velocity, and hold fine particles in place.
Minimize the presence of bare soil vulnerable to erosion and soil runoff to surface waters and implement erosion control, sediment, and stormwater management practices in non-cropped areas.
Maintain existing, naturally occurring, riparian vegetative cover (such as trees, shrubs, and grasses) in aquatic habitat areas as necessary to minimize the discharge of waste; maintain riparian areas for effective streambank stabilization and erosion control, stream shading and temperature control, sediment and chemical filtration, aquatic life support, and wildlife support to minimize the discharge of waste.
Update an existing or develop and implement a new farm water quality management plan.
Obtain appropriate farm water quality education and technical assistance necessary to achieve compliance with this Order.
Tier 2 and Tier 3 Dischargers also must:
Submit an Annual Compliance Form electronically to provide up-to-date information so the Water Board can evaluate the effect of agricultural waste discharges on water quality, and the effectiveness of waste discharge control or pollution load reduction from implementation of management practices, treatment or control measures, or changes in farming practices to comply with this Order.

Evaluate the nitrate loading risk factor (as high, medium or low) for each ranch/farm , annually.
Conduct Photo monitoring to document the condition of perennial, intermittent, or ephemeral streams and riparian and wetland area habitat, and demonstrate compliance with Basin Plan erosion and sedimentation requirements, if have a farm/ranch that contains or is adjacent to a waterbody identified on the Clean Water Act Section 303(d) List of Impaired Waterbodies as impaired for sediment, temperature or turbidity.
Record total nitrogen applied for each ranch/farm if have high nitrate loading risk.
Tier 3 Dischargers also must:
Conduct individual discharge monitoring
Determine the typical crop nitrogen uptake for each crop type produced if have nitrate loading risk.
Develop and implement a certified Irrigation and Nutrient Management Plan (INMP) to meet specified nitrogen balance ratio targets if have high nitrate loading risk.
Meet the following Nitrogen Balance ratio targets or implement an alternative to demonstrate an equivalent nitrogen load reduction: for crops in annual rotation (such as a cool season vegetable in a triple cropping system), achieve a Nitrogen Balance ratio target equal to one (1); for crops occupying the ground for the entire year (e.g., strawberries or raspberries) must achieve a Nitrogen Balance ratio target equal to 1.2.
Develop a Water Quality Buffer Plan to protect listed waterbody and its associated perennial and intermittent tributaries, including adjacent wetlands as defined by the Clean Water Act, from discharges of waste, if have a farm/ranch that contains or is adjacent to a waterbody identified on the Clean Water Act Section 303(d) List of Impaired Waterbodies as impaired for sediment, temperature or turbidity.

Description of Monitoring

The Draft Agricultural Order proposes the following types of monitoring for Dischargers in each Tier as follows.

Tier 1: Receiving surface water monitoring and individual groundwater sampling

Tier 2: Receiving surface water monitoring, individual groundwater sampling, and individual riparian and wetland photo-monitoring

Tier 3: Receiving surface water monitoring, individual groundwater sampling, individual riparian and wetland photo-monitoring, and individual surface water discharge monitoring

B. Summary of Time Schedule for Compliance

Table 2 describes the general time schedules to comply with conditions of the Order for all dischargers. Table 3 describes the same for Tier 2 and Tier 3 Dischargers. Table 4 describes milestones..

Table 2. Time Schedule for Key Compliance Dates All Dischargers (Tier 1, Tier 2, Tier 3)

CONDITIONS	COMPLIANCE DATE[1]
Submit Notice of Intent (NOI)	Within 30 days of adoption of Order or Within 30 days acquiring ownership/ control, and prior to any discharge or commencement of activities that may cause discharge.
Submit Update to NOI	Within 30 days, upon adoption of Order and upon change
Submit Notice of Termination	Immediately, when applicable
Submit Monitoring Reports per MRP	Per date in MRP
Implement, and update as necessary, management practices to achieve compliance with this Order.	Ongoing
Protect existing aquatic habitat to prevent discharge of waste	Immediately
Submit surface receiving water quality monitoring annual report	Within one year, and annually thereafter by January 1
Develop/update and implement Farm Plan	October 1, 2012
Install and maintain adequate backflow prevention devices.	October 1, 2012
Submit groundwater sampling results and information	October 1, 2013
Properly destroy abandoned groundwater wells.	October 1, 2015

Table 3. Additional Time Schedule for Key Compliance Dates for Tier 2 and Tier 3 Dischargers

CONDITIONS	COMPLIANCE DATE
Tier 2 and Tier 3:	
Submit electronic Annual Compliance Form	October 1, 2012, and updated annually thereafter by October 1.
Submit photo documentation of riparian or wetland area habitat (if operation contains or is adjacent to a waterbody impaired for temperature, turbidity, or sediment)	October 1, 2012, and every four years thereafter by October 1.
Calculate Nitrate Loading Risk level and report in electronic Annual Compliance Form	October 1, 2012, and annually thereafter by October 1.
Submit total nitrogen applied in electronic Annual Compliance Form (if discharge has High Nitrate Loading Risk)	October 1, 2014, and annually thereafter by October 1.
Only Tier 3:	

Initiate individual surface water discharge monitoring	October 1, 2011
Determine Crop Nitrogen Uptake (if discharge has High Nitrate Loading Risk)	October 1, 2012
Submit individual surface water discharge monitoring data	October 1, 2013 and annually thereafter by October 1
Develop Irrigation and Nutrient Management Plan (INMP) or alternative (if discharge has High Nitrate Loading Risk)	October 1, 2013
Submit INMP elements in electronic Annual Compliance Form (if discharge has High Nitrate Loading Risk)	October 1, 2014, and annually thereafter by October 1
Achieve Nitrogen Balance Ratio target equal to one (1) for crops in annual rotation (e.g. cool season vegetables) or alternative, (if discharge has High Nitrate Loading Risk)	October 1, 2014
Achieve Nitrogen Balance Ratio target equal to 1.2 for annual crops occupying the ground for the entire year (e.g. strawberries or raspberries) or alternative, (if discharge has High Nitrate Loading Risk)	
Submit Water Quality Buffer Plan or alternative (if operation contains or is adjacent to a waterbody impaired for temperature, turbidity, or sediment)	October 1, 2015
Submit INMP Effectiveness Report (if discharge has High Nitrate Loading Risk)	October 1, 2015

Table 4. Milestones

MILESTONES[1]	DATE
Tier 1, Tier 2 and Tier 3:	
Measurable progress towards water quality standards in waters of the State or of the United States[1], or Water quality standards met in waters of the State or of the United States.	Ongoing October 1, 2015
Only Tier 3:	
<u>Pesticide and Toxic Substances Waste Discharges to Surface Water</u> *- One of two individual surface water discharge monitoring samples is not toxic* *- Two of two individual surface water discharge monitoring samples are not toxic*	 *October 1, 2012* *October 1, 2013*

Sediment and Turbidity Waste Discharges to Surface Water *- Four individual surface water discharge monitoring samples are collected and analyzed for turbidity.* *- 75% reduction in turbidity or sediment load in individual surface water discharge relative to October 1, 2012 load (or meet water quality standards for turbidity or sediment in individual surface water discharge)*	 *October 1, 2012* *October 1, 2013*
Nutrient Waste Discharges to Surface Water *- Four individual surface water discharge monitoring samples are collected and analyzed* *- 50% load reduction in nutrients in individual surface water discharge relative to October 1, 2012 load (or meet water quality standards for nutrients in individual discharge)* *- 75% load reduction in nutrients in individual surface water discharge relative to October 1, 2012 load (or meet water quality standards for nutrients in individual surface water discharge)*	 *October 1, 2012* *October 1, 2013* *October 1, 2014*
Nitrate Waste Discharges to Groundwater *- Achieve annual reduction in nitrogen loading to groundwater based on Irrigation and Nutrient Management Plan effectiveness and load evaluation*	 *October 1, 2013 and annually thereafter*

[1] Indicators of progress towards milestones includes, but is not limited to data and information related to a) management practice implementation and effectiveness, b) treatment or control measures, c) individual discharge monitoring results, d) receiving water monitoring results, and e) related reporting.

C. Justification for Staff Recommendations and Options Considered

[NOTE TO READER:This section was added to the Staff Report and was not contained in the November 19, 2010 Staff Report.]

Staff drafted the 2011 Draft Agricultural Order based on review of data and information collected by the Water Board (e.g., Central Coast Ambient Monitoring Program water quality data), review of related literature, and information gathered through numerous discussions with agricultural representatives, environmental organization representatives, environmental justice organization representatives, agency staff, farmers and other members of the public. Staff also evaluated and compared several options (some recommended and some considered) to determine which regulatory tool, tiering criteria, conditions and requirements to recommend. The options considered and the justification for the recommended requirements are discussed in detail in

Appendix D. Where a specific recommendation is based on published information, staff referenced the source of that information directly in the 2011 Draft Agricultural Order. Where staff reasoned a recommendation using best professional judgment, the rationale for the recommendation is provided either in this Staff Report, Appendix D or in the 2011 Draft Agricultural Order. The following paragraphs summarize the justification for the main components of the 2011 Draft Agricultural Order and those areas that received the most public comment.

Recommended Regulatory Tool – Conditional Waiver of Waste Discharge Requirements

Staff considered a variety of regulatory tools (e.g. conditional waiver, individual or general waste discharge requirements) and combinations of those tools for the regulation of agricultural discharges (see Appendix D – Options Considered). Each regulatory tool can be structured to achieve protection of water quality and associated beneficial uses.

To build upon the existing 2004 Conditional Waiver, Staff recommended the continued use of a conditional waiver with the addition of tiers. Dischargers are familiar with many of the terms and conditions of the 2011 Draft Agricultural Order, since they generally build upon those contained within the existing 2004 Conditional Waiver. Staff found that it is appropriate to adopt a conditional waiver of Reports of Waste Discharge (ROWDs) and Waste Discharge Requirements (WDRs) for this category of discharges because, as a group, the discharges have the same or similar waste from the same or similar operations and use the same or similar treatment methods and management practices (e.g., source control, irrigation efficiency - reduced agricultural irrigation runoff, reduced chemical use, nutrient management, cover crops, erosion control, vegetative treatment systems, etc.). In addition, the 2011 Draft Agricultural Order provides for an efficient and effective use of Water Board resources, given the magnitude of the discharges and number of persons who discharge waste from irrigated lands. The 2011 Draft Agricultural Order and tiering structure also provides reasonable flexibility for the Dischargers who seek coverage under this Order by providing them with a reasonable time schedule and options for complying with the Water Code commensurate with the specific level of waste discharge and threat to water quality.

The 2011 Draft Agricultural Order is in the public interest because the 2011 Draft Agricultural Order requires compliance with water quality standards and includes conditions that are intended to eliminate, reduce and prevent pollution and nuisance and protect the beneficial uses of the waters of the State. In addition, the 2011 Draft Agricultural Order tiering structure focuses on the highest priority water quality issues and most severely impaired waters.

Recommended Structure for Agricultural Order - Tiers

Staff considered different tiering methods for the 2011 Draft Agricultural Order (see Appendix D – Options Considered). The 2011 Draft Agricultural Order establishes three tiers of regulation based on specific criteria selected to take into account the characteristics of a specific operation, the level of waste discharge, relative threat to water quality, and known information about local water quality conditions.

Staff developed general tiering criteria in the 2011 Draft Agricultural Order and described in detail below. These tiering criteria were selected because they provide good indicators of threat to water quality from individual operations, account for surface and ground water quality conditions in the Central Coast Region, can be determined efficiently by agricultural operators and the Water Board by simple surveys of agricultural operations, and they provide a reasonable approach for scaling regulatory requirements according to actual or potential effects of waste discharges on water quality. Owners/operators do not have to collect additional data or conduct complicated or expensive site evaluations to determine which tier applies to their operations. Finally, the tiering system proposed provides for an owner or operator of agricultural lands enrolling in the Order to present additional information to justify a more appropriate tier for their operations if warranted. Tier 1 includes Dischargers with a very low level of waste discharge and very limited threat to water quality (similar to a low-threat discharge). Tier 2 includes Dischargers with a moderate level of waste discharge and moderate threat to water quality. Tier 3 includes Dischargers with the highest level of waste discharge and highest threat to water quality.

Staff considered requiring discharge monitoring and reporting from all Discharges to comprehensively evaluate specific quality of discharge from individual operations for the purposes of discharge characterization and establishing tiers (see p. 24 of Appendix D – Individual Discharge Characterization Monitoring). Sufficient data regarding individual discharges is currently not available such that it could be used for the purposes of tiering. Staff found that it was unreasonable to impose such discharge characterization monitoring and reporting requirements on all Dischargers. Individual discharge characterization monitoring would require a significant amount of resources by every Discharger to implement, and a significant amount of resources by Staff to evaluate. In addition, the use of individual discharge characterization monitoring would likely result in a significant amount of time necessary before the Discharger or Water Board could assign the appropriate tier, delaying the implementation of requirements.

Staff included the tiering criteria described in the 2011 Draft Agricultural Order in response to early stakeholder comments that the order must not be “one size fits all”, that the Board should consider “the scale of water quality risks and potential loading posed by smaller operations compared to larger operations”, that the Board should “impose the least requirements for areas that are not impaired”, that the Board should consider “existing indicators of risk, including the nitrate hazard index”, and specifically that the Board should consider “tiers” to scale level of requirements. In addition, staff also recommended tiering criteria to facilitate implementation of requirements to initiate focus on the highest priority operations with the greatest relative threat to water quality in the most impaired areas. Finally, staff also considered the complexity of the proposed tiering criteria with the goal of selecting criteria that enabled the Board and growers to quickly identify the appropriate tier.

Staff evaluated the number of operations and estimated total acreage that would be included in each Tier based on criteria described in the 2011 Draft Agricultural Order, and Water Board enrollment data and information from the County Agricultural Commissioners. As illustrated in Table 5, staff estimates that the fewest number of operations would be included in the proposed Tier 3 and that the most operations would be included in the moderate Tier 2. Conversely, staff estimates that the largest total acreage would be included in Tier 3 and the lowest acreage would be included in Tier 1. This is consistent with the fact that the recommended Tier 3 criteria are focused on the largest operations with relatively higher threat to water quality and Tier 1 characteristics represent lower threat, smaller operations.

Table 5. Summary of estimated number of operations and acreage in Draft Ag Order tiers.

SUMMARY	Tier 3	Tier 2	Tier 1	Total
Estimated Total Operations	377	1367	1256	3000
% Total Operations	13%	46%	42%	100%
Estimated Total Acreage	233,000	110,000	92,000	435,000
% Total Acreage	54%	25%	21%	100%

The defining characteristics for the recommended 2011 Draft Agricultural Order tiers include: 1) use of specific pesticides known to cause toxicity and surface water impairments, including chlorpyrifos and diazinon, 2) location of operation in proximity to an impaired waterbody, 3) production of crop types with high potential for nitrate loading, and 4) operation size. In addition, based on stakeholder comments on the 2011 Draft Agricultural Order received during the public comment period, staff recommends an additional tiering criterion related to location of operation in proximity to a public water system well that is polluted by nitrate. The basis for these tiering criteria is explained in detail below.

Tiering Criteria – Use of Specific Pesticides, Including Chlorpyrifos and Diazinon

Staff considers low-threat operations that do not use chemicals known to cause water quality problems as a lower priority for monitoring and reporting requirements in the 2011 Draft Agricultural Order. In the Central Coast region, there are currently forty-five Clean Water Act 303(d) impaired waterbody listings for toxicity, twenty-six listings for chlorpyrifos, and thirteen listings for diazinon. In addition, there is substantial evidence that chlorpyrifos and diazinon are major causes of severe toxicity in agricultural areas (see 2011 Draft Agricultural Order findings 58, 68-78). Thus, staff finds that Dischargers who apply these chemicals may discharge these chemicals in irrigation and stormwater runoff, and pose a relatively greater risk to water quality than those Dischargers who do not apply these chemicals. Furthermore, staff finds that Dischargers who apply these chemicals at operations adjacent to streams already impaired for toxicity and pesticides are the highest priority for monitoring and reporting requirements in the Draft Ag Order.

Staff considered including alternative or additional chemicals for use in tiering criteria. For example, staff considered using existing high risk or restricted use pesticides developed by the Department of Pesticide Regulation (DPR). At the time of staff's evaluation, many of the pesticides on these DPR lists were not in broad use locally and were not yet documented to cause toxicity or pesticide specific surface water or groundwater problems in the Central Coast region. Staff decided not to use general high risk or restricted use pesticide lists because they were not necessarily related to water quality problems in the Central Coast region and because such tiering criteria could result in an unnecessary burden to growers. Staff also considered including those specific pesticides that were in agricultural use and detected in surface waters in the Central Coast region. The list of pesticides detected in the Central Coast region is very extensive (more than 75 individual pesticides, see 2011 Draft Agricultural Order finding #69) and would result in a very complicated tiering process. To focus on priority water quality issues and provide for a less complicated tiering process, staff chose to include only those pesticides that are currently documented as a primary cause of toxicity in the Central Coast region –

chlorpyrifos and diazinon. (Relatedly, staff recommended monitoring requirements to track effects of other pesticides causing toxicity so dischargers, the Water Board or members of the public can respond to new or increasing problems from other chemicals.)

Tiering Criteria – Location of Operation in Proximity to an Impaired Surface Waterbody-

Staff considers low-threat operations in unimpaired areas as a low priority for monitoring and reporting requirements in the 2011 Draft Agricultural Order. Staff recommends proximity to impaired waterbodies as a tiering criterion, and specific monitoring and reporting requirements for Dischargers in closest proximity to impaired surface waterbodies

The proximity distance of 1000 feet is commonly used in evaluations of preliminary environmental site assessment, source water assessment, sanitary surveys to evaluate the watershed for surface water sources and vulnerability assessments for groundwater sources, and similar evaluations of potentially contaminating activities. In such examples, potentially contaminating activities within 1000 feet (or similar distance) are evaluated in the context of posing an increased threat to water quality relative to those activities outside 1000 feet. The 2011 Draft Agricultural Order prioritizes operations located near an impaired waterbody as higher priority for implementation of this Order compared to similar operations not located near an impaired waterbody.

As a related example, California Department of Health Services (CDPH) requires public water systems to identify possible contaminating activities (PCAs) that are considered potential sources of contamination within drinking water source areas (for surface water bodies and groundwater wells) and its protection zones (CDPH, 2000). Possible contaminating activities include activities associated with both microbiological and chemical contaminants. CDPH evaluates possible contaminating activities and potential risk to water sources based on risk ranking and proximity to the water source. CDPH identifies agricultural drainage from irrigated crops as a possible contaminating activity associated with a moderate to high potential risk ranking, primarily relating to chemical contaminants. In general, CDPH requires an assessment of potentially contaminating activities within the watershed for surface water sources, and recommends a distance of between 400 and 2500 feet for surface water protection zones. In the case of groundwater sources and chemical contamination, CDPH recommends a minimum radius of 1000 to 2250 feet for the purposes of assessing vulnerability to potentially contaminating activities and protecting groundwater wells.

While the purpose of the CDPH assessments are focused on evaluating risk to drinking water sources, the same methodology can be applied for the purposes of identifying and evaluating possible contaminating activities at risk for impacting any surface water or groundwater source. Efforts to conduct preliminary environmental site assessments, sanitary surveys, and environmental vulnerability assessments utilize similar methodologies.

Staff estimated the number of operations that would be included in various proximal distances to impaired surface waterbodies, based on Water Board enrollment data and information from the County Agricultural Commissioners Office (Table 6).

Table 6. Comparison of proximal distance to impaired surface waterbodies and estimated number of operations in proximal area

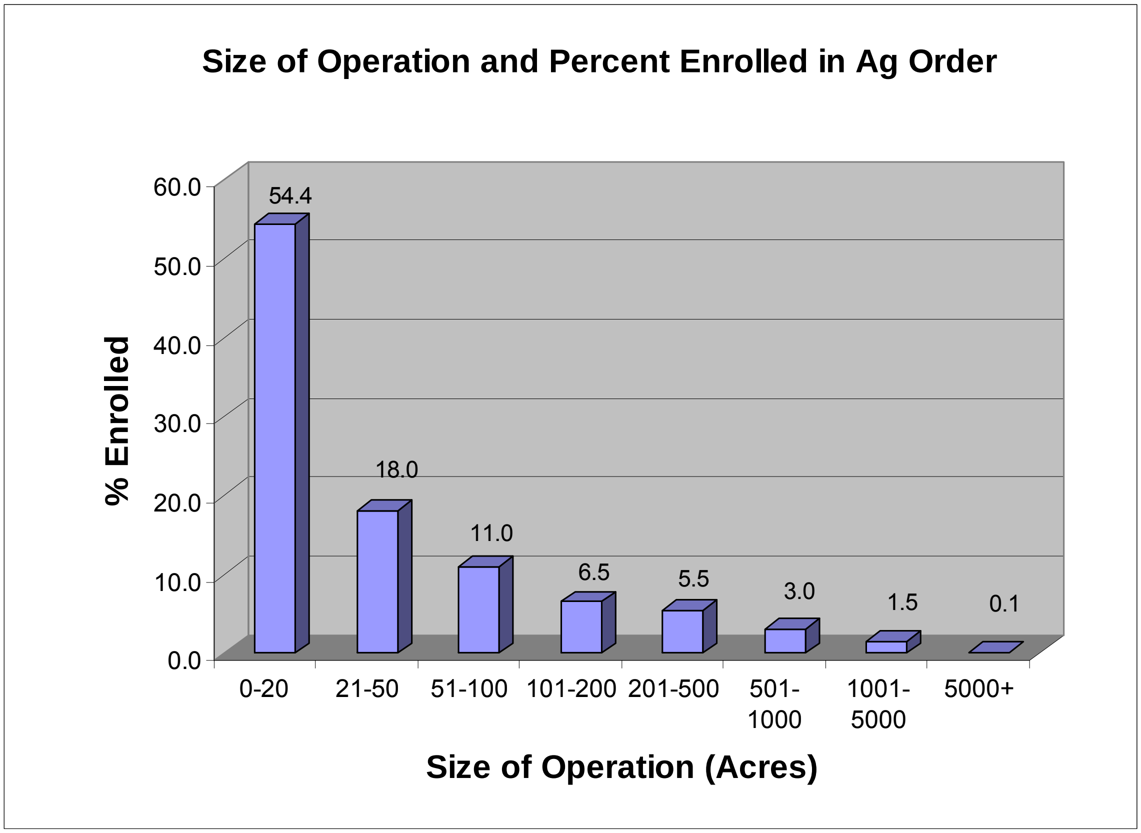
Proximal Distance to Impaired Surface Waterbody	Estimated Number of Operations	Estimated Percent of Total Operations
1000 feet	880	30%
500 feet	682	23%
250 feet	586	20%

Tiering Criteria - Production of Crop Types with High Nitrate Loading Risk and Operations greater than 1000 acres-

Nitrate pollution of groundwater drinking water supplies is a critical problem throughout the Central Coast Region (see Draft Ag Order findings 34-52). The protection of drinking water sources is among the highest priorities for this order. There is substantial evidence that specific crops (identified in Draft Ag Order finding 52) load more nitrate to groundwater relative to other crops and pose a greater threat to water quality, especially drinking water. Additional crops with high nitrate loading potential have been identified by public comments, including crops in the Brassica family with high nitrate loading potential, leafy greens with high nitrate loading potential, artichokes, beans, beets, com, cucumber, daikon, leek, onion, peas, pepper, pumpkin, potato, radishes, squash, strawberries, and tomatoes. In addition, in many cases, the production of these crops also involves the application of chlorpyrifos and diazinon, presenting additional threat to water quality. Staff prioritized operations producing these crops for specific conditions and prohibitions, including monitoring and reporting requirements.

Staff prioritized larger operations that produce crops likely to load nitrate to groundwater and using chemicals known to cause toxicity to focus initial implementation efforts. Staff acknowledges that operations less than 1000 acres may discharge similar or greater amounts of waste, and thus pose similar or greater risk to water quality. Staff estimated that 33 (2%) of approximately 1900 Dischargers enrolled in the existing 2004 Conditional Waiver have operations greater than or equal to 1000 acres (see Figure 2). Staff found it reasonable to prioritize initial implementation efforts on this limited number of dischargers who discharge a relatively high level of waste or pose a high threat to water quality. It is important to note that the 2011 Draft Agricultural Order requirements for Tier 3 Dischargers require dischargers to evaluate nitrate loading risk at the farm or ranch level and implement specific irrigation and nutrient management requirements only for those farms/ranches that have the greatest potential of nitrate loading.

Figure 3. Percent of total operations enrolled in existing Ag Order compared to size of operation in acres.



Tiering Criteria – Location of Operation in Proximity to Public Water System Polluted by Nitrate-

As stated above, nitrate pollution of groundwater drinking water supplies is a critical problem throughout the Central Coast Region (see Draft Ag Order findings 34-52). As a result, the protection of drinking water sources is among the highest priorities for this order. In the Central Coast Region, approximately 263 public water system wells exceed the drinking water standard for nitrate. In response to stakeholder comments on the Draft Ag Order received during the public comment period, staff is recommending an additional tiering criterion related to location of operation in proximity to a public water system well that is polluted by nitrate. Consistent with proximal distances recommended by the DPH for source water assessment and protection, staff is proposing an additional Tier 2 criterion that would include growers who produce crops with high potential to discharge nitrogen to groundwater and within 1000 feet of a public water system polluted by nitrate (but less than 1000 acres).

Staff evaluated the number of operations that are within 1000 feet of a public water system well with exceedances above the nitrate drinking water standard and estimates that an additional 15 operations would be included in Tier 2 (that are not already included based on other Tier 2 criteria).

Moving Between Tiers-

For tiering, the 2011 Draft Order includes a process for Dischargers to move to a different tier, if information they submit shows a lower level of discharge or lower threat to water quality. Staff clarified this issue in the 2011 Draft Agricultural Order (see condition #15). The Order states that "Dischargers may submit a request to the Executive Officer to approve transfer to a lower tier. The request must provide information to demonstrate a lower level of waste discharge and a lower threat to water quality, including site-specific operational and water quality information. Dischargers remain in the tier determined by the criteria above, and must meet all conditions for that tier until the Executive Officer approves the request to transfer to a lower tier." Thus, if the Discharger provides evidence that treatment has effectively removed pollutants from the discharge and the Discharger plans to maintain such treatment or control, then the Executive Officer can determine that this Discharger can be designated in a lower tier.

Recommended Implementation Conditions and Requirements

Staff considered a variety of conditions and requirements to regulate discharges of waste from agricultural operations (see Appendix D – Options Considered). To build upon the existing 2004 Conditional Waiver, Staff included a majority of the terms and conditions in the existing 2004 Conditional Waiver in the 2011 Draft Agricultural Order, as well as revised or new conditions to better protect water quality in agricultural areas and to better measure progress towards water quality improvement and compliance with water quality standards.

Consistent with the legal requirements and goals and criteria established by the Water Board for developing the 2011 Draft Agricultural Order and feedback from Water Board members and stakeholders, staff 1) included specific conditions and requirements such as short term actions to protect human health and prioritize protection of drinking water, 2) targeted the most impaired areas and prioritized operations with greatest potential for waste discharges to affect water quality, and 3) required less monitoring and reporting for operations with the lowest potential for waste discharges to affect water quality.

Specifically, the 2011 Draft Agricultural Order includes general prohibitions and conditions targeting priority water quality issues in agricultural areas (nitrate in groundwater, toxicity/pesticides, nutrients in surface water, sediment/turbidity) for all Dischargers with minimal monitoring and reporting for the lowest threat operations in areas without water quality impairments (Tier 1). To protect drinking water, staff included additional conditions for Tier 2 and Tier 3 dischargers to evaluate the nitrate loading risk and to report total nitrogen applied at those operations with high nitrate loading risk operations. To further protect drinking water supplies from the effects of waste discharge from operations that pose the highest threat, staff included conditions for Tier 3 operations with high nitrate loading risk to also implement an Irrigation and Nutrient Management Plan. Additionally, to prevent sediment, turbidity, and temperature waste discharges adjacent to already impaired surface waterbodies, the 201 1 Draft Agricultural Order requires the highest risk operations in Tier 3 to also implement a Water Quality Buffer Plan.

Staff found that in a general comparison with the existing 2004 Conditional Waiver, the recommended 2011 Draft Agricultural Order Tier 1 requirements represent fewer requirements than the existing 2004 Conditional Waiver. Tier 2 requirements are comparable to the 2004 Conditional Waiver, with a few additional reporting requirements to better indicate effectiveness of management practices and reduction in pollutant loading. Tier 3 requirements are greater than the 2004 Conditional Waiver. Staff recommended these implementation conditions and requirements, based upon the tiering criteria, because they are reasonable and appropriate given the severity and magnitude of water quality problems in the agricultural areas of the Central Coast region.

Furthermore, many of the conditions in the 2011 Draft Agricultural Order are consistent with water quality management practices and measures of effectiveness or pollution loading already implemented by many growers effectively and promoted by technical experts and technical assistance providers working in the Central Coast region. Several examples follow below. Field demonstrations conducted by University of California Cooperative Extension (UCCE) documented that improved fertilizer management and efficient irrigation management practices for vegetable production significantly reduces off-site nutrient loss and that current fertilization practices can be improved without risk of crop loss (Hartz et al, 2009; Pettygrove et al, 2003). Technical assistance providers also promote minimizing and protecting bare soil areas to reduce soil erosion and waste discharge to surface water (ANR, 2004). In another example, the Central Coast Vineyard Team Sustainable in Practice (SIP) certification requires vineyard operations to implement a vegetated perimeter buffer of no less than 25 feet from the edge of perennial and intermittent streams and wetland areas to control erosion and off site movement of contaminants (Central Coast Vineyard Team, 2011). Related to groundwater quality, technical experts at the Natural Resources Conservation Service (NRCS) and University of California Division of Agriculture and Natural Resources also recommend groundwater sampling of domestic wells and irrigation wells at a frequency of once or twice a year because shallower wells are prone to short-term variations in groundwater quality and contamination (ANR, 2003).

Recommended Monitoring and Reporting Requirements

Staff considered a variety of monitoring and reporting requirements for inclusion in the 2011 Draft Agricultural Order (see Appendix D – Options Considered). To build upon the existing 2004 Conditional Waiver, staff included the continuation of surface water receiving water monitoring, implemented individually or by a cooperative monitoring program. To address drinking water protection as the highest priority for the 2011 Draft Agricultural Order, staff included basic groundwater sampling and reporting for nitrate in domestic drinking water wells and primary irrigation well at all agricultural operations. In addition, staff included basic annual reporting for moderate threat operations (Tier 2) to document status and effectiveness of waste discharge control and pollution reduction at operations and due to changes or management practices. For higher risk operations still within Tier 2 (high nitrate loading risk or operations containing or adjacent to 303(d) Listed Waterbodies impaired for sediment, turbidity, or temperature) staff included additional reporting of total nitrogen applied annually and photo monitoring, respectively.

For a limited number of the highest risk operations (Tier 3), staff included more stringent monitoring and reporting requirements related to the effective implementation of irrigation and nutrient management and water quality buffer plans, and individual discharge monitoring to evaluate waste discharge control, affects on receiving water, and progress towards milestones and compliance with the 2011 Draft Agricultural Order.

Staff finds that the recommended monitoring and reporting requirements, are commensurate with the level of waste discharge and threat to water quality with desired focus on the highest water priorities, and are reasonable and appropriate given the severity and magnitude of water quality problems in the agricultural areas of the Central Coast region. Additionally, these types of monitoring and reporting requirements are necessary for compliance and consistency with the Water Code and State Nonpoint Source Policy requirements to include monitoring that demonstrates effectiveness of the Order, protects water quality and makes this type of information available to the public.

Recommended Milestones and Timeframes

Adequate timeframes and milestones are necessary to evaluate and ensure timely compliance and progress towards water quality improvement. Staff considered a variety of milestones and timeframes to regulate discharges of waste from agricultural operations (see Appendix D – Options Considered). The 2011 Draft Agricultural Order did not set achievement of water quality objectives in receiving waters within the timeframe of the 2011 Draft Agricultural Order, as staff recognizes that it will take time to address all sources of pollution and fully resolve the severe water quality impairments. However, the conditions and requirements in the 2011 Draft Agricultural Order include measurable indicators of progress towards meeting water quality objectives and set short timeframes so both the indicators and appropriate responses to the indicators can be evaluated and improved in the short-term, if necessary. For the subset of dischargers that pose the highest threat (Tier 3), the 2011 Draft Agricultural Order sets timeframes of two to five years to show pollutant load reduction in individual discharges to surface water and to show pollutant load reduction in discharge to groundwater. Staff's recommendation for milestones and timeframes is based upon known half-lives of pesticides known to cause toxicity (e.g. half-lives of chlorpyrifos and diazinon are significantly less than two years) and demonstrated success at reducing nutrient and sediment loading through on-farm improvements implemented as part of grant-funded projects, waste discharge control required by the Water Board and independently by individual growers.

In the case of irrigation efficiency projects, many successful grant-funded examples exist in the Central Coast Region where growers were able to significantly reduce their irrigation run-off and in some cases, completely eliminate tailwater during the irrigation season within a 3-year timeframe. Similar examples exist related to nutrient management, with resulting fertilizer efficiency and reduction in nutrient load to surface water and groundwater. For example, the Cachuma Resource Conservation District worked with a number of growers to implement an Irrigated Agriculture Best Management Practices (BMP) Implementation grant which reported the following water quality improvements over a 3-year period from 2006 - 2009: 645 tons of nitrate-nitrogen fertilizer application were eliminated; 20,710 tons of soil were prevented from entering the waterways; 276 acres of strawberries had at least 1 application of pesticide eliminated; 833 acre feet per year (ac-ft/yr) of irrigation water were conserved; 24.65 tons of nitrate-nitrogen conserved with irrigation water (Prop 50 Ag Water Quality Grant Program, 2009). Another grant project implemented at several individual vineyard operations reported average soil erosion reduction of 15 tons/acre/year measured using the RUSLE 2model over a 3-year period (Central Coast Vineyard Team, 2005). Examples also exist at the watershed scale, demonstrating effective wetland treatment of large fractions of nitrate and suspended sediment inputs with retention times of several days, and some treatment of nutrients and pesticides over longer retention times (Prop 13 NPS Grant Program, Gabilan Watershed).

In the case of nutrient management practices, there are many documented cases where growers achieved annual fertilizer application reductions by up to 50% in some cases, which significantly reduces the potential for nitrogen loading to groundwater. In addition, the effective implementation of vegetative treatment systems have demonstrated significant nitrate removal from surface water (in some cases ~50% NO3-N removed) has also been reported within the term of 3-year grant projects. In the Franklin Creek watershed in Santa Barbara County, compliance with Water Board regulatory actions taken in 2002 led to a decline in nitrate loading from waste discharges from nurseries and greenhouses. Nitrate concentrations have been on a steady (and statistically significant) decline in Franklin Creek since then. This represents a change of approximately 30% decrease in nine years for receiving water, with an unreported but likely significant improvement in loading from individual discharges. In another location, in a small watershed where agricultural activity ceased completely (and voluntarily), a 90% decline in nitrate concentrations was documented in five years in receiving water. Complete cessation of agricultural activity is not a viable or desirable waste discharge control option, but cessation of the nitrate sources in these cases represents the magnitude of change that is possible in receiving waters and the direct cause and effect between farming practices and water quality.

While the 2011 Draft Agricultural Order provides for various alternative methods to achieve compliance, the above examples demonstrate that significant improvement can be measured within the five-year term of the 2011 Draft Agricultural Order and timeframes described within. Staff found that the recommended milestones and timeframes are reasonable and appropriate given the severity and magnitude of water quality problems in the agricultural areas of the Central Coast region.

4. DEVELOPMENT OF THE DRAFT AGRICULTURAL ORDER

A. Results of Public Outreach/Comparison of Alternatives and Proposals

Workshop Outcomes

At the Workshop on May 12, 2010, staff presented a summary of water quality conditions, preliminary draft staff recommendations, and an evaluation of the alternatives submitted that concluded the agricultural alternatives did not meet the criteria set forth by the Board nor the water quality goals and requirements that staff established as necessary for a revised order when development of the 2011 Draft Agricultural Order began prior to December 2008. Staff evaluated the Farm Bureau Proposal subsequently submitted by agricultural representatives on December 3, 2010. This proposal came closer to meeting the goals and requirements but staff concluded that the Farm Bureau Proposal does not comply with basic statutory requirements and falls short of containing requirements that will resolve the water quality problems effectively given their severity and magnitude. The Farm Bureau Proposal is discussed in detail in Appendix D. Options Considered. In summary, staff identified the following limitations in the Farm Bureau Proposal:

- Monitoring:
    - Does not require monitoring that measures the effectiveness of on-farm management practices or pollutant load reduction;
    - All individual farm or operation data and information to be kept confidential;
    - Does not require individual or operation-level monitoring, but indicates it is optional for all growers, even high risk;
- Milestones and Timeframes:

    - Milestones indicate very limited progress towards meeting legal water quality standards, and many waterbodies will still exceed most legal water quality standards;
    - Long timeframes for very limited progress toward surface water quality milestones (4-10 years versus 2-3 years in Draft Ag Order);
    - No milestones or timeframes for groundwater loading or groundwater quality conditions;
- Reporting:
    - Does not include individual or farm or operation-level water quality sampling;
    - Management practice reporting includes results of surveys indicating if and which practices used, but not if effective at preventing or reducing pollution loading;
    - Includes aggregated information reporting for implementation actions (e.g. results for group of operations in a sub-watershed);
    - Content of aggregated reports unspecified (e.g. data will be collected during audits which will result in "points" based on unspecified criteria);
- Inconsistent with Plans and Policies:
    - Does not include measures of progress or achievement of legal water quality standards;
    - Does not include required measures of effectiveness of management practices;
    - Limits the Board's authority and discretion to enforce when the Board finds or measures discharges of wastes or exceedances of water quality standards by defining compliance with the "waiver" as implementation of farm water quality practices;
- Enforceability
    - The Proposal is not enforceable with respect to individual discharges of waste due the lack of specific monitoring and reporting, and the way coalitions would be set up.

Staff also identified the following benefits or improvements in the Farm Bureau Proposal:

- Contains implementation of management practices that address pollutant loading from irrigation, pesticides, sediment, and fertilizer;
- Contains surveys, audits and coalitions to assist growers to adapt and improve operations to improve water quality.
- Prioritizes operations growing crops with high potential to discharge nitrogen to surface and groundwaters (using same criteria as November 19, 2010 Draft Agricultural Order).

The Farm Bureau Proposal is compared to the earlier alternatives in Table 7 below per the requirements and goals the Water Board and staff set for revising the 2004 Conditional Waiver. The general requirements and components for a revised Order are shown in the bold headings in the columns. The detailed information in each cell is the unique component from each alternative proposed for each of the general components for a revised Order.

Table 7. Evaluation of Alternatives[1] based on Agricultural Order Requirements[2]

Authority	Legal Requirement	Confirmation of Compliance	Point of Compliance	Milestone(s) to Measure Progress	Time to Compliance
Porter-Cologne, Basin Plan	Eliminate toxic discharges of agricultural pesticides to surface waters and groundwater	Farm Bureau: Practice survey reporting; Coalition audit aggregated summary reports; Watershed scale monitoring and reporting	Farm None Watershed scale, in stream	General management practice implementation; 50% reduction in chlorpyrifos and diazinon toxic units; meet Water Quality Objectives (WQOs)	4 years for toxic units; 8 years to meet WQOs
		OSR: Individual monitoring (no reporting); Cooperative monitoring and reporting; Practice checklist reporting; Biannual aggregated summary of implementation and water quality	None Watershed scale, in stream None None	General management practice implementation	5 years for education; 2 years for farm plan and checklist
		ENV: On- farm monitoring and reporting; Watershed scale monitoring and reporting; Farm plan compliance document reporting	Farm; Edge of farm; Watershed scale, in stream Farm; Edge of farm	Meet WQOs in discharge Various indicators of practice effectiveness to control waste discharges or reduce pollution load (e.g. reduced volume of runoff)	Within a few months Annually

Authority	Legal Requirement	Confirmation of Compliance	Point of Compliance	Milestone(s) to Measure Progress	Time to Compliance
Porter-Cologne, Basin Plan	Reduce nutrient discharges to surface waters to meet nutrient standards	Farm Bureau: Practice survey reporting;	Farm	General management practice implementation;	
		Coalition audit aggregated summary reports;	None		
		Watershed scale monitoring and reporting	Watershed scale, in stream	10% load reduction	10 years
		OSR: Individual monitoring (no reporting);	None		
		Cooperative monitoring and reporting;	Watershed scale, in stream		
		Practice checklist reporting;	None	General management practice implementation	5 years for education; 2 years for farm plan and checklist
		Biannual aggregated summary/survey of implementation and water quality	None		
		ENV: On- farm monitoring and reporting;	Farm; Edge of farm;	Meet WQOs in discharge	
		Watershed scale monitoring and reporting;	Watershed scale, in stream		
		Farm plan compliance document reporting	Farm; Edge of farm	Various indicators of practice effectiveness to control waste discharges or reduce pollution load (e.g. total nitrogen applied)	4 years
		OSR: None	None	None	None

Authority	Legal Requirement	Confirmation of Compliance	Point of Compliance	Milestone(s) to Measure Progress	Time to Compliance
Porter-Cologne, Basin Plan	Reduce nutrient discharges to groundwater to meet groundwater standards	Farm Bureau: Practice survey reporting; Coalition audit aggregated summary reports; Well sampling annually (no reporting)	Farm None None	Nutrient management plan	1 year
		OSR: None	None	None	None
		ENV: On- farm monitoring and reporting Groundwater basin scale monitoring and reporting; Farm plan compliance document reporting	Farm; On-farm Basin scale, groundwater Farm; Edge of farm	Eliminate or measure reduced nitrate in discharge Various indicators of practice effectiveness to control waste discharges or reduce pollution load (e.g. total nitrogen applied)	6 years Annually
Porter-Cologne, Basin Plan	Minimize sediment discharges from agricultural lands	Farm Bureau: Practice survey reporting; Coalition audit aggregated summary reports; Watershed scale monitoring and reporting	Farm None Watershed scale, in stream	General management practice implementation 20 % load reduction	5 years
		OSR: Individual monitoring (no reporting); Cooperative monitoring and reporting;	None Watershed scale, in stream		

Authority	Legal Requirement	Confirmation of Compliance	Point of Compliance	Milestone(s) to Measure Progress	Time to Compliance
		Practice checklist reporting; Biannual aggregated summary/survey of implementation and water quality	None None	General management practice implementation	5 years for education; 2 years for farm plan and checklist
		ENV: On- farm monitoring and reporting; Watershed scale monitoring and reporting; Farm plan compliance document reporting	Farm Watershed scale, in stream Farm	Meet WQOs in discharge Various indicators of practice effectiveness to control waste discharges or reduce pollution load (e.g. vegetative cover for bare soil)	3 years

[1]Alternatives:
Farm Bureau = CA Farm Bureau Federation and other Ag Organizations, December 3, 2010 version
OSR = OSR Enterprises, Inc.
ENV = Monterey Coast keeper and other Environmental Organizations
[2]Requirements established as framework for development of Draft Ag Order in December 2008

In Table 8, below, all the alternatives and proposals submitted are compared more generally to the 2004 Conditional Waiver and 2011 Draft Agricultural Order. Each alternative, proposal or order appears in a cell in the table if the alternative, proposal or order addresses the component representing that cell. For example, all six of the alternatives, proposals or orders include some form of reporting or monitoring to confirm compliance with the requirement to “eliminate toxic discharges of agricultural pesticides to surface waters and groundwater” so their abbreviations (per the key at the bottom of Table 8) appear in the cell labeled “Confirmation of Compliance” on the same line that has “eliminate toxic discharges of agricultural pesticides to surface waters and groundwater” in the cell labeled “Legal Requirement.” For another example, only the alternative submitted by Monterey Coast Keeper and other Environmental Organizations (ENV) and the 2011 Draft Agricultural Order (DRAFT) include explicit dates by which dischargers must reduce nutrient discharges to groundwater to meet groundwater standards so their abbreviations appear in the cell labeled “Time to Compliance” on the same line that has “reduce nutrient discharges to groundwater to meet groundwater standards” in the cell labeled “Legal Requirement.”

Table 8. Comparison of Alternatives based on Agricultural Order Requirements

Comparison of Alternatives[1] based on Agricultural Order Requirements[2]					
Authority	**Legal Requirement**	**Confirmation of Compliance**	**Point of Compliance**	**Milestone(s) to Measure Progress**	**Time to Compliance**
Porter-Cologne, Basin Plan	Eliminate toxic discharges of agricultural pesticides to surface waters and groundwater	FARM BUREAU OSR ENV 2011 ORDER 2004 WAIVER	FARM BUREAU ENV 2011 ORDER 2004 WAIVER	FARM BUREAU OSR ENV 2011 ORDER	FARM BUREAU OSR ENV 2011 ORDER
Porter-Cologne, Basin Plan	Reduce nutrient discharges to surface waters to meet nutrient standards	FARM BUREAU OSR ENV 2011 ORDER 2004 WAIVER	FARM BUREAU ENV 2011 ORDER 2004 WAIVER	FARM BUREAU OSR ENV 2011 ORDER	FARM BUREAU OSR ENV 2011 ORDER
Porter-Cologne, Basin Plan	Reduce nutrient discharges to groundwater to meet groundwater standards	FARM BUREAU ENV 2011 ORDER 2004 WAIVER	FARM BUREAU ENV 2011 ORDER	ENV 2011 ORDER	ENV 2011 ORDER
Porter-Cologne, Basin Plan	Minimize sediment discharges from agricultural lands	FARM BUREAU OSR ENV 2011 ORDER 2004 WAIVER	FARM BUREAU ENV 2011 ORDER 2004 WAIVER	FARM BUREAU OSR ENV 2011 ORDER	FARM BUREAU OSR ENV 2011 ORDER
Porter-Cologne, Basin Plan	Protect aquatic habitat	OSR ENV 2011 ORDER 2004 WAIVER	ENV 2011 ORDER	ENV 2011 ORDER	ENV 2011 ORDER

[1]Alternatives:
Farm Bureau = CA Farm Bureau Federation and other Ag Organizations, December 3, 2010 version
OSR = OSR Enterprises, Inc.
ENV =Monterey Coast keeper and other Environmental Organizations
2011 ORDER = 2011 Draft Agricultural Order
2004 WAIVER = Existing 2004 Conditional Waiver for Irrigated Agriculture
[2]Requirements established as framework for development of Draft Ag Order in December 2008

The Board listened to public comments on the recommendations, and public presentations on proposed alternatives for regulating agricultural waste discharges. More than 375 members of the public attended the meeting and more than 80 individuals addressed the Water Board.

Proponents of the various alternatives described their alternatives to the Board. Interested persons, including regulated agricultural owners and operators, agricultural industry representatives, environmental protection agencies and organizations, environmental justice advocates for clean drinking water for rural residents, and several other members of the public, showed both support and opposition for the Order and commented on the following issues. A wide range of views were expressed on each issue:

- The effects of agricultural waste discharges on beneficial uses, including drinking water;
- Costs to clean up the nitrate being transferred to the public, increased health care costs, bottled water costs, and missing work;
- Complexity, cost, and feasibility of requirements
- Timelines to compliance;
- The collaborative process;
- Numeric requirements, streamside buffers and riparian protections;
- individual farm monitoring;
- Legality and appropriateness of the alternatives

Board members offered their own comments on what they heard at the Workshop and read in the staff reports and preliminary Draft Agricultural Order. Some of the key comments that Board members made include:

- Tiered approach and phasing are essential; we need to focus on short term actions that address drinking water concerns. The worst areas should be addressed first.
- How do we coordinate with the food safety issues?
- Will there be enough staff to analyze all the information being requested from the Ag community?
- Will we be able to protect proprietary information requested in the farm plans?
- A required education element should be considered (15 hours in five years?).
- Need reasonable timelines.
- Individual Waste Discharge Requirements might have a role.
- There should be enforcement on the remaining growers that are not enrolled.
- Water quality issues identified are real and need to be addressed; consider prioritization of the issues.
- Perhaps the next waiver should look like a ten year plan and consider other components, and lay the framework at how we are going to get at all these issues.

Board members concluded that staff should move forward with next steps considering stakeholder and Board member input from the Workshop, meeting with stakeholders further and preparing a revised Draft Agricultural Order. They also agreed to continue the Workshop at the July Board meeting in Watsonville.

On Thursday, July 8, 2010 the Water Board held a public workshop continuing the May 12 public workshop. Staff received 16 additional comment letters. These comments generally covered issues similar to the comments submitted prior to the May 12 Board Workshop and included:

General Support for Preliminary Draft Agricultural Order (over 880 letters including multiple copies of some form letters):

- Support for the process, the Agricultural Regulatory Program and preliminary draft recommendations for an updated Agricultural Order.
- Support for the prioritization of agricultural water quality and urges Water Board to take timely actions to prevent further degradation.
- Support for the regulation of agricultural waste discharges to groundwater and the protection of drinking water sources.
- Support for requirements for individual groundwater monitoring, including private domestic wells and submittal of data and technical reports.

General Concern about Preliminary Draft Agricultural Order (over 200 letters):

- Requirements will result in economic hardship.
- Requirements will result in crop yield reductions and farmers will go out of business.
- The current process is inadequate, including California Environmental Quality Act (CEQA) requirements and specifically requirements to consider the social, environmental and economic impacts, and evaluate alternatives.
- Lack of cooperation with the growers and farm organizations to develop requirements.
- Objections to proposed aquatic habitat requirements.
- Objections to individual monitoring and reporting.

At the workshop, commenters presented the following issues and made the following comments:

- Advocacy for "SMART" sampling which is similar to the current confidential on-farm monitoring that the Cooperative Monitoring Program (CMP) conducts;
- Examples of ranchers who have adapted their practices and operations in response to SMART sampling to improve water quality;
- Expert presentations on technical hurdles of reducing nitrate loading to levels protective of water quality;
- Advocacy for individual discharger monitoring and riparian protection;
- Advocacy for protecting drinking water quality and preventing related public health impacts
- Consideration of individual commodities (like strawberries);
- Need for flexibility;
- Need to evaluate technical feasibility of water quality improvements;
- Need for long timeframes;
- Include education requirements;
- Set reasonable and scientifically determined targets;
- Recognize benefits and challenges (costs and effectiveness) of riparian and vegetative buffers.
- Agricultural alternatives do not meet the criteria set forth by the Board.

Board members made the following observations:

- Affects to human health are the highest priority and need a short-term response;
- Build on original draft, and use good ideas heard at workshop;
- Support tiered approach and prioritizing where main problems are and based on commodities that are biggest risks;

- Consider recommendation to allow two years of private monitoring, and then require submittal of data and make it public;
- Focus on what staff can do in the next five years given reduced resources;
- Refine tiers beyond just impaired and unimpaired areas; also consider threats to water quality; find ways to tier requirements for groundwater affects;
- Measure trends and hope to show improvements and meeting goals;
- No need for another workshop but anyone who wants to offer information to the Board should submit it or contact staff.

Staff incorporated all of the Water Board member's suggestions in the Draft Agricultural Order by:

- Building on the preliminary Draft Agricultural Order distributed on February 1, 2010
- Making human health protection the highest priority for waste discharge control
- Including short term actions that will immediately improve and protect drinking water
- Targeting the most impaired areas
- Prioritizing operations with highest risk for their waste discharge to affect water quality
- Using prioritization criteria that provide integration of water quality impairments (their locations, severity and human health risks) with characteristics of operations that inform where and which operation are highest risk for discharging waste that affects water quality (e.g., size, crop types, fertilizer and pesticide use), thereby increasing efficiency
- Including more implementation, monitoring and reporting requirements for the high risk operations
- Including specific timeframes to reduce waste discharge and pollutant loading from high risk operations
- Including targeted monitoring and reporting to collect best information to determine reductions in waste discharges, reductions in pollutant loading, and water quality improvements in receiving surface and ground- waters
- Including reduced monitoring and reporting for operations with low risk discharges
- Allowing proprietary information to remain in Farm Plans and only requiring reporting of information that indicates effectiveness of waste discharge control practices and reductions in pollutant loads
- Streamlining reporting information and improving information management systems and tools so staff can more efficiently and effectively evaluate data and information so limited staff resources are focused on highest priority compliance assistance and enforcement activities

Public Outreach Meetings

Following the release of the draft report and supporting documents and continuing through September 2010, Staff participated in several outreach meetings and events. To ensure a diverse representation of stakeholders, staff initially made a deliberate effort to engage stakeholders who were not represented on the Ag Panel and who were not already actively participating in the process to renew the Agricultural Order, including technical assistance providers, municipalities, environmental justice organizations, and agricultural industry groups not yet involved. In addition to discussing potential conditions and alternatives, staff met with stakeholders to discuss water quality conditions and priorities, methods to outreach to underrepresented groups, technical considerations associated with achieving water quality standards, potential costs of compliance to agriculture and potential costs to communities affected by agriculture. Staff also met specifically with representatives from agriculture and specific commodity groups.

Specific outreach meetings and events are shown in Table 9.

Table 9. Agricultural Order Renewal Outreach Meetings and Event

DATE	MEETING / EVENT
November 17, 2009	Staff Presentation at 2009 Sustainable Ag Expo in San Luis Obispo, sponsored by the Central Coast Vineyard Team
January 12, 2010	Staff Presentation at American Society of Agronomy Conference, California Certified Crop Advisers
February 17, 2010	Monterey Coastkeeper
February 22, 2010	Santa Cruz County, Resource Conservation District of Santa Cruz County, and Big Sur Land Trust
March 3, 2010	San Luis Obispo County Water Resources Advisory Committee
March 8, 2010	Technical Assistance Providers (University of California Cooperative Extension, Cal Poly Irrigation Training Research Center, Monterey Bay National Marine Sanctuary, Natural Resources Conservation Service, Resource Conservation District of Monterey County)
March 9, 2010	Staff Presentation to Spanish speaking growers and irrigators - Annual Monterey County Ag Expo
March 17, 2010	California Strawberry Commission
March 22, 2010	San Luis Obispo County Farm Bureau – North Coast Farm Center
March 23, 2010	The Commonwealth Scientific and Industrial Research Organization (CSIRO) and Antinetti Consulting, Inc.
March 30, 2010	Central Coast Vineyard Team, Department of Pesticide Regulation, State Water Resources Control Board, Central Valley Regional Water Quality Control Board
April 11, 2010	Executive Officer Presentation to Association of California Water Agencies on Water Quality and Water Supply
April 14, 2010	Agricultural Water Quality Alliance (Monterey Bay National Marine Sanctuary, Resource Conservation District of Monterey County, Natural Resources Conservation Service, Central Coast Agricultural Water Quality Coalition, Central Coast Water Quality Preservation, Inc., Resource Conservation District of Monterey County, University of California Cooperative Extension, AWQA RCDs)
April 28, 2010	Interagency Meeting (U.S. Environmental Protection Agency, U.S. Fish and Wildlife, California Department of Public Health, California Department of Water Resources, California Department of Food and Agriculture, California Department of Fish and Game, California State Parks, County public health agencies, County Agriculture Commissioners)
April 28, 2010	Stanford Law School – Environmental Law Clinic, Monterey Coastkeeper
April 29, 2010	Farm, Food Safety, Conservation Network
April 30, 2010	California Association of Nurseries and Garden Centers, University of California Cooperative Extension
May 12, 2010	Central Coast Water Board Public Workshop – San Luis Obispo
May 24, 2010	Staff Presentation to Spanish speaking growers - Agriculture & Land-Based Training Association
July 8, 2010	Central Coast Water Board Public Workshop – Watsonville
August 16, 2010	Multiple Agricultural Stakeholders: CA Farm Bureau Federation, County Farm Bureaus, Coalition, Grower-Shipper Association, Strawberry Commission, Central Coast Vineyard Team,and Other Agricultural Industry Representatives

August 16, 2010	Public Meeting: Scoping for California Environmental Quality Act
August 17, 2010	Environmental Defense Center, Monterey Coastkeeper, Surfrider, Santa Barbara Channelkeeper, Environmental Justice Coalition for Water
August 18, 2010	CA Association of Nurseries and Garden Centers, Nursery/Greenhouse Representatives
August 19, 2010	San Luis Obispo County Farm Bureau, Local Agricultural Representatives
September 8, 2010	California Strawberry Commission
November 10, 2010	Board Member field trip to runoff treatment sites in Monterey County
November 15, 2010	Staff Presentation at Sustainable Ag Expo in Seaside, Monterey County, sponsored by Central Coast Vineyard Team
December 1, 2010	Staff Presentation at Western Plant Health Association Conference
December 3, 2010	Staff Presentation at Cal Poly Sustainable Agriculture Conference
December 6, 2010	Staff Panel Participation At CA Farm Bureau Federation Annual Conference
December 7, 2010	The Commonwealth Scientific and Industrial Research Organization (CSIRO) and Antinetti Consulting, Inc.
December 14, 2010	California Strawberry Commission
December 15, 2010	Multiple Agricultural Stakeholders: CA Farm Bureau Federation, Santa Clara County Farm Bureau, Grower-Shipper Association, Santa Barbara County Farm Bureau, Monterey County Farm Bureau, Western Growers, Cut Flower Commission, Central Coast Vineyard Team, Central Coast Water Quality Preservation Inc. and Other Agricultural Industry Representatives
December 15, 2010	Central Coast Water Quality Preservation Inc.
January 10, 2011	Staff Presentation to San Luis Obispo County Public Health Commission
January 28, 2011	California Avocado Commission
February 3, 2011	Central Coast Water Board Public Workshop – San Luis Obispo
February 18, 2011	Environmental Defense Center, Monterey Coastkeeper, Santa Barbara Channelkeeper, San Luis Obispo Coastkeeper, Environmental Justice Coalition for Water.
February 24, 2011	Staff Presentation to Spanish speaking growers and irrigators - Annual Monterey County Ag Expo

<u>Changes in Response to Public Input</u>

Staff changed the Preliminary Draft Agricultural Order based on feedback received from stakeholders and included the following changes in the 2011 Draft Agricultural Order.

- removed conditions related to rainwater and containerized plants;
- clarified the intent to address irrigation runoff in the short term with immediate conditions vs. tiledrains in the long term;
- removed "tributaries" as a consideration for prioritizing farming operations in close proximity to impaired waterbodies for more stringent or immediate conditions;
- revised the table of high risk pesticides;
- revised aquatic habitat conditions;
- revised the level of prescription in conditions ;
- developed a compliance document for reporting instead of using the Farm Plan;
- included evaluations or milestones for pollutant loading in exchange, or in addition to, pollutant concentrations;
- evaluated and developed additional ways to define tiers of dischargers and associated conditions based on relative threat to water quality and apply the most stringent compliance requirements to highest threat tier;

- increased and staggered timeframes for compliance with various requirements;
- evaluated and developed additional options for monitoring and reporting that scale monitoring requirements so highest threat dischargers have more monitoring requirements than lower threat dischargers.

B. Summary of Public Comments on Draft Agricultural Order

[NOTE TO READER: THIS IS A PLACEHOLDER FOR A SUMMARY OF COMMENTS. SUMMARY WILL BE PROVIDED AS A SUPPLEMENTAL SHEET TO THE WATER BOARD.]

C. Summary of Environmental Setting and Water Quality Conditions

1. Water Resources on the Central Coast

The Central Coast Region's coastal and inland water resources are unique, special, and in some areas still of relatively high quality. Many Central Coast residents depend heavily on groundwater for drinking water from both deep municipal supply wells and shallow domestic wells. In addition, the region supports some of the most significant biodiversity of any temperate region in the world and is home to many sensitive natural habitats and species of special concern. These resources and the beneficial uses of the Central Coast water resources are severely affected or threatened by agricultural waste discharges.

Thousands of people rely on public supply wells with unsafe levels of nitrate and other pollutants. Excessive nitrate concentration in drinking water is a significant public health issue resulting in risk to infants for methemoglobinemia or "blue baby syndrome", and adverse health effects (i.e., increased risk of non-Hodgkin's, diabetes, Parkinson's disease, Alzheimers, endocrine disruption, cancer of the organs) among adults as a result of long-term consumption exposure. Staff estimates several additional thousands of people are drinking from shallow private domestic wells. Shallow groundwater is generally more directly susceptible to pollution from overlying land use. Groundwater quality data collection from shallow wells (especially agricultural or domestic drinking water wells) is not yet required and data is only broadly available, thus limiting evaluations related to potential public health risks and shorter term indications of water quality changes. For these wells, water quality is not regulated, not treated, or treated at significant cost to the well owner.

Agricultural discharges of fertilizer are the main source of nitrate contamination to groundwater based on local nitrate loading studies. In some cases, up to 30 percent of applied nitrogen may have leached to groundwater in the form of nitrate. Due to elevated concentrations of nitrate in groundwater, many public water supply systems have abandoned wells and established new wells or sources of drinking water, or are required to remove nitrate before delivery to the drinking water consumer, often, at significant cost.

Agricultural waste discharges have impaired surface water quality in the Central Coast Region, such that some creeks are found toxic (lethal to aquatic life) every time the site is sampled and as a result many areas are devoid of aquatic organisms essential to ecological systems.

Vertebrates, including fish, rely on invertebrates as a food source. Consequently, invertebrates are key indicators of stream health, and are commonly used for toxicity analyses and assessments of overall habitat condition. The majority of creeks, rivers and estuaries in the Central Coast Region are not meeting water quality standards. Most of these waterbodies are affected by agriculture. These conditions were determined and documented on the Central Coast Water Board's 2008 Clean Water Act Section 303(d) List of Impaired Waterbodies. The three main forms of pollution from agriculture are excessive runoff of pesticides and toxicity, nutrients, and sediments. In a statewide study, the Central Coast Region had the highest percentage of sites with pyrethroid pesticides detected and the highest percentage of sites exceeding toxicity limits. In addition, there are more than 46 waterbodies that exceed the nitrate water quality standard and several waterbodies routinely exceed the nitrate water quality standard by five-fold or more. In addition to causing the human health affects discussed previously, these high levels of nitrate are affecting sensitive fish species such as the threatened Steelhead, endangered Coho Salmon, by causing algae blooms that remove oxygen from water, creating conditions unsuitable for aquatic life.

The water quality conditions throughout the region are also affecting several other threatened and endangered species, including the marsh sandwort (*arenaria paludicola*), Gambel's watercress (*nasturtium rorippa gambelii*), California least tern (*sterna antillarum browni*), and red-legged frog (*Rana aurora*). The last remaining known populations of the two endangered plants, marsh sandwort and Gambel's watercress, occur in Oso Flaco Lake, are critically imperiled and depend upon the health of the Oso Flaco watershed to survive.

2. Summary of Groundwater Quality Conditions

To develop a comprehensive assessment of groundwater quality in agricultural areas throughout the Region, staff evaluated available groundwater data collected by the California Department of Water Resources, California Department of Public Health (CDPH), U.S. Geological Survey (USGS), State Water Resources Control Board (SWRCB) Groundwater Ambient Monitoring and Assessment (GAMA) Program, Lawrence Livermore National Laboratory (LLNL), local and county water resources agencies, and researchers. Although available groundwater quality data generally represent conditions at the groundwater basin and sub-basin scale, these data indicate widespread and severe nitrate affects due to agricultural land uses over a broad scale given major portions of entire groundwater basins or aquifers are severely affected with nitrate in areas subject to intensive irrigated agricultural activity. Groundwater quality data for the purposes of characterizing specific individual agricultural waste discharges are generally not available. However, a growing number of studies are available showing a direct link between irrigated agricultural practices and ongoing and significant nitrate loading to groundwater. In addition, numerous studies indicate nitrate in groundwater is the most significant water quality problem nationally, statewide and within the Region and that commercial fertilizer is the primary source of loading, particularly in areas of intensive agriculture.

The report contained within Appendix G focuses primarily on nitrogen/nitrate pollution. The report also refers to a more limited body of data that indicates irrigated agriculture is likely responsible for widespread leaching of salts and discharges of other chemicals such as pesticides with the potential to affect drinking water beneficial uses.

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An evaluation of the sources of nitrogen, nitrogen loading to groundwater from irrigated agriculture and groundwater quality conditions is detailed in Appendix G to this staff report (with references cited) and summarized below.

Sources of Nitrogen Input and Loading Analyses -

- Fertilizer accounts for approximately 69 percent of the estimated available nitrogen input regionally of the three largest sources of nitrogen within the Region related to human activities (fertilizer, human waste and livestock waste).
- Approximately 83.6 percent of the estimated nitrogen loading to groundwater in the Salinas Valley is attributable to the commercial application of agricultural fertilizers.
- Approximately 45,404 tons of nitrogen were applied on average every year for agricultural purposes within the Region between 1998 and 2008.
- Over 17,000 tons of nitrogen (75,225 tons of nitrate) has been estimated to discharge/leach to groundwater on average every year for the last ten years from irrigated agriculture in the Region. This equates to an average groundwater loading of approximately 74 pounds of nitrogen (327.5 pounds of nitrate) per cropping acre of irrigated agriculture per year.
- For lettuce, nitrogen leachate concentrations of 104.9 to 178 mg/L nitrate-N were documented in a 2009 study in the Salinas Valley. These leachate concentrations are approximately 10 to 18 times the drinking water standard (using the federal standard convention of 10 mg/L nitrate-N for comparison) and would consequently require up to 18 times as much clean groundwater flowing under the site as the water percolating down from irrigation (volume of leachate) to dilute the water to the standard. And of course up gradient water is typically not "clean," but also carries some nitrogen load. Based on 2008 and 2009 county Ag Commissioner cropping acre data, lettuce accounts for approximately 45 percent of the cropping acres in Monterey County and 38 percent in the Region. Lettuce typically requires less fertilizer-nitrogen application than the four other primary crops grown in the Region, strawberries, broccoli, cauliflower and celery.
- A 2005 report by Lawrence Livermore National Laboratory indicates that nitrate affects within the shallow aquifer of the Llagas subbasin are due to more recent fertilizer-nitrogen loading and not that of legacy farming practices or other sources. Groundwater ages in shallow aquifer wells east of Gilroy containing nitrate concentrations, exceeding twice the drinking water standard, were determined to be less than seven years old and in some locations less than two years old. Similarly, preliminary data from a 2010 LLNL special study indicated that shallow wells sampled in the Arroyo Seco area also had relatively "young" groundwater-about five years old.
- The potentially significant loading of salts to groundwater from irrigated agriculture warrants the collection and analysis of groundwater quality data for salt constituents and metrics of salinity within and around agricultural areas.

Nitrate Affects on Groundwater Beneficial Uses -

- 55 percent of the drinking water standard violations in public supply wells (for water systems with fifteen or more service connections) in the Central Coast Region were attributable to nitrate (data from Department of Water Resources).
- Approximately 9.4 percent of all public water supply wells in the Region had concentrations of nitrate in excess of the drinking water standard between 1994 and 2000.
- 18 percent of public supply wells within the Salinas Valley groundwater basin (excluding the Paso Robles subbasin), contained nitrate in excess of the drinking water standard during the period between 1979 and 2009. Excluding the Seaside, Langley and Corral de Tierra subbasins of the Salinas Valley groundwater basin that are not as intensively farmed but are subject to greater potential nitrogen loading from septic systems, the number of wells containing nitrate in excess of the drinking water standard increased to 23 percent. Approximately 37 percent of the public supply wells in the Salinas Valley contained nitrate concentrations between background levels and the drinking water standard.

- 27 percent of public supply wells in the Santa Maria groundwater basin contained nitrate in excess of the drinking water standard. 40 percent of the wells contained nitrate concentrations between background levels and the drinking water standard.
- 19 percent of the small water supply system (with two to 14 service connections) wells sampled in Monterey County exceeded the nitrate drinking water standard and 44 percent contained nitrate concentrations between background levels and the drinking water standard during the 2008-2009 fiscal year.
- 55.3 percent of the 508 domestic wells sampled in the Llagas subbasin had concentrations of nitrate in excess of the drinking water standard at levels and up to 4.5 times the drinking water standard, as well as average and median nitrate concentrations just above the drinking water standard during a voluntary nitrate sampling program conducted in 1998. Comparison of the 1998 domestic well data with three previous domestic well studies indicated that average nitrate concentrations within domestic wells in the Llagas subbasin increased steadily from 19.5 mg/L nitrate-NO_3 in 1963 to 47.7 mg/L nitrate-NO_3 in 1998. The relative percentage of wells with nitrate in excess of the drinking water standard increased from 11.3 to 55.3 percent in the Llagas subbasin during this time period.

Pesticide in Groundwater-

- 6.9 percent of wells sampled in the Region contained pesticides, although numerous well sampling data collected by DPR between 1984 and 2009 indicated pesticides are infrequently detected above preliminary health goals or drinking water standards.

3. Summary of Surface Water Quality Conditions

Surface water bodies throughout the region are degraded as evidenced by high levels of nitrates and consistent toxicity measurements. The highest nitrate concentrations and most severe toxicity occur in agricultural watersheds.

To determine surface water conditions, staff reviewed data collected by CMP and CCAMP, and conducted a review of other water quality available water quality information, for marine areas for example, in the Central Coast Region.

Surface water conditions are detailed in Attachment G to this staff report and summarized below.

Indicators of Surface Water Quality Impairment-

- Most of the same areas that showed serious contamination from agricultural pollutants five years ago are still seriously contaminated.
- The proposed 2010 Clean Water Act Section 303(d) List of Impaired Waters for the Central Coast Region (Impaired Waters List) identifies surface water impairments for approximately 167 water quality limited segments related to a variety of pollutants (e.g., salts, nutrients, pesticides/toxicity, and sediment/turbidity). Sixty percent of the surface water listings identified agriculture as one of the potential sources of water quality impairment.
- Agricultural waste discharges most severely affect surface waterbodies in the lower Salinas and Santa Maria watersheds, both areas of intensive agricultural activity. Evaluated through a multi-metric index of water quality, 82 percent of the most degraded sites in the Central Coast Region are in these agricultural areas.

- Nitrate concentrations in areas that are most heavily affected are not improving significantly or in any widespread manner and in a number of sites in the lower Salinas/Tembladero and Santa Maria watershed areas appear to be getting worse in the last few years (from CCAMP and CMP data) .
- Thirty percent of all sites from CCAMP and CMP have average nitrate concentrations that exceed the drinking water standard, and approximately 60 percent exceed the level identified to protect aquatic life. Several of these water bodies have average nitrate concentrations that exceed the drinking water standard by five-fold or more. Some of the most seriously polluted waterbodies include the Tembladero Slough system (including Old Salinas River, Alisal Creek, Alisal Slough, Espinosa Slough, Gabilan Creek and Natividad Creek), the Pajaro River (including Llagas Creek, San Juan Creek, and Furlong Creek), the lower Salinas River (including Quail Creek, Chualar Creek and Blanco Drain), the lower Santa Maria River (including Orcutt-Soloman Creek, Green Valley Creek, and Bradley Channel), and the Oso Flaco watershed (including Oso Flaco Lake, Oso Flaco Creek, and Little Oso Flaco Creek).
- Toxicity is widespread in Central Coast waters, with 65 percent of all waterbodies monitored for toxicity showing some measure of lethal effect. Twenty-nine waterbodies are on the proposed 2010 Clean Water Act, Section 303(d) List of Impaired Waters because of sediment and/or water toxicity.
- Ninety percent of severely toxic sites are in agricultural areas of the lower Santa Maria and Salinas/Tembladero watershed areas.
- Waste discharges from a number of agricultural drains have shown toxicity nearly every time the drains are sampled. Researchers collaborating with CCAMP have shown that these toxic discharges can cause toxic effects in river systems that damage benthic invertebrate communities.
- Water column invertebrate toxicity is primarily associated with high concentrations of diazinon and chlorpyrifos pesticides; sediment toxicity is likely caused by chlorpyrifos and pyrethroid pesticide mixtures.
- Agricultural use of pyrethroid pesticides in the Central Coast Region and associated toxicity are among the highest in the state. In a statewide study of four agricultural areas conducted by the Department of Pesticide Regulation (DPR), the Salinas study area had the highest percent of surface water sites with pyrethroid pesticides detected (85 percent), the highest percent of sites that exceeded levels expected to be toxic (42 percent), and the highest rate (by three-fold) of active ingredients applied (113 lbs/acre).
- Agricultural waste discharges contribute to sustained turbidity with many sites heavily influenced by agricultural waste discharges exceeding 100 NTUs as a median value. For comparison, most CCAMP sites have a median turbidity level of under 5 NTUs. Resulting turbidity greatly exceeds levels that affect the ability of salmonids to feed. Many of these more turbid sites are located in the lower Santa Maria and Salinas-Tembladero watersheds.
- Lack of shading in creek channels modified for agricultural purposes can cause water temperatures to exceed levels that are healthy for salmonids. Several high temperature areas are in major river corridors that provide rearing and/or migration habitat for salmonids. These include the Salinas, Santa Maria, and Santa Ynez rivers.
- Bioassessment data shows that creeks in areas of intensive agricultural activity have impaired benthic communities. Aquatic habitat is often poorly shaded, high in temperature, and has in-stream substrate heavily covered with sediment.
- Several Marine Protected Areas (MPAs) along the Central Coast are at risk of pollution affects from sediment and water discharges leaving river mouths. Three of the MPAs,

Elkhorn Slough, Moro Cojo Slough and Morro Bay, are estuaries that receive runoff into relatively enclosed systems. In two of these MPAs (Moro Cojo Slough and Elkhorn Slough), nitrates, pesticides and toxicity are documented problems.

- Research in the Monterey Bay area has shown that discharge of nitrate from the Salinas and Pajaro river systems can increase the initiation and development of phytoplankton blooms, and some of these blooms have resulted in the deaths of hundreds of sea birds.

Indicators of Surface Water Quality Trends -

- Some drainages in the Santa Barbara area are improving in nitrate concentrations (such as Bell Creek, which supports agricultural activities) and on Pacheco Creek in the Pajaro watershed. A number of locations in the lower Salinas and Santa Maria areas show increasing nitrate concentrations over the past five years of the CMP. However, flow volumes have declined at some of these sites, so at these locations nitrate loads may not necessarily be getting worse in spite of upward trends in concentrations;
- Dry season flow volume is declining in some areas of intensive agriculture, implying reductions in tailwater volume;
- Detailed flow analysis by the CMP showed that 18 of 27 sites in the lower Salinas and Santa Maria watersheds had statistically significant decreases in dry season flow over the first five years of the program;
- CCAMP monitoring has detected declining flows at other sites elsewhere in the Region, likely because of drought;
- Several sites along the main stem of the Salinas River showed significant increases in turbidity during the dry season; significant decreases in turbidity were seen at two locations in the Santa Maria watershed.
- One CCAMP monitoring site on the Salinas Reclamation Canal (309JON) shows statistically significant improvement in survival of invertebrate test organisms in water.

Surface Water Quality Data and Information Gaps -

- The timeframe and frequency of data collection, especially for toxicity, limit the evaluation of statistical trends for some water quality parameters in surface waterbodies;
- In-stream water quality is an effective long-term measure of water quality improvement (especially for nutrients), and more time may be necessary in some locations to identify significant change.
- In-stream water quality monitoring data is necessary to show compliance with Total Maximum Daily Loads and to list or delist waterbodies from the Clean Water Act, Section 303(d) List of Impaired Waters. These are both key Water Board management tools.
- Flow information and water quality data are not reported for agricultural waste discharges from individual farms, so correlations cannot be made between reductions in irrigation runoff or improvements in agricultural discharge quality and in-stream changes.
- Because there is no individual on-farm monitoring or reporting, it is unknown how individual farms contribute to surface water quality improvement or impairment. In addition, it is unknown if individual Dischargers are in compliance with water quality standards (given the magnitude and scale of documented affects, it is highly likely that most waste discharges are not in compliance).
- In Marine Protected Areas, there is no monitoring of sediments that carry pesticides in attached forms. Without this information it is difficult to determine if these pesticides, carried downstream attached to sediments and discharged to the ocean, harm marine life.

- Additional research could increase understanding of the affects of nutrient discharges from rivers to nearshore ocean waters.

4. Summary of Aquatic Habitat Conditions

Aquatic habitat is degraded in many areas of the region as evidenced by poor biological and physical conditions. Most surface waterbodies in agricultural watersheds are not suitable for safe recreational fishing or to support aquatic life.

To determine aquatic habitat conditions, staff reviewed data collected by CMP and CCAMP, and conducted a review of available riparian and wetland information for the Central Coast Region. While the 2004 Conditional Waiver did not specifically require aquatic habitat monitoring, it stated that cooperative monitoring of in-stream effects would enable the Water Board to assess the overall affect of agricultural waste discharges to beneficial uses, such as aquatic life and habitat. The 2004 Conditional Waiver also requires protection of beneficial uses including aquatic and wildlife habitat. The proposed 2010 order continues that requirement.

Aquatic habitat conditions are detailed in Appendix D and G to this staff report and summarized below.

Indicators of Aquatic Habitat Degradation -

- Agricultural activities result in the alteration of riparian and wetland areas, and continue to degrade the waters of the State and associated beneficial uses. Owners and operators of agricultural operations historically removed riparian and wetland areas to plant cultivated crops and in many areas continue to do so.
- As a result of riparian and wetland habitat degradation, watershed functions that serve to maintain high water quality, aquatic habitat and wildlife - by filtering pollutants, providing shade and protection from predators, recharging aquifers, providing flood storage capacity, have been disrupted.
- Data collected from CCAMP and CMP indicate that population characteristics of aquatic insects (benthic macroinvertebrates) important to ecological systems reflect poor water quality, degradation or lack of aquatic habitat, and poor overall watershed health at sites in areas with heavy agricultural land use. Aquatic habitat is often poorly shaded, high in temperature, and stream bottoms are heavily covered with sediment.
- The lower Salinas watershed and lower Santa Maria watersheds score low for common measures of benthic macroinvertebrate community health and aquatic habitat health.
- Unstable, bare dirt and tilled soils, highly vulnerable to erosion and stormwater runoff, are common directly adjacent to surface waterbodies in agricultural areas. Erosion and stormwater runoff from agricultural lands contribute sediment and sustained turbidity at levels that affect the ability of salmonids to feed. Many of these sites are located in the lower Santa Maria and Salinas-Tembladero watersheds.
- Degradation of aquatic habitat also results in water temperatures that exceed levels that are desirable for salmonids at some sites in areas dominated by agricultural activity. Several of these sites are in major river corridors that provide rearing and/or migration habitat for salmonids. These include the Salinas, Santa Maria, and Santa Ynez rivers.
- Real and/or perceived incompatible demands between food safety and environmental protection and subsequent actions taken by Dischargers to address food safety concerns associated with environmental features have resulted in the removal of aquatic habitat and related management practices.

- According to a Spring 2007 survey by the Resource Conservation District of Monterey County (RCDMC), 19 percent of 181 respondents said that their buyers or auditors had suggested they remove non-crop vegetation from their ranches. In response to pressures by auditors and/or buyers, approximately 15 percent of all growers surveyed indicated that they had removed or discontinued use of previously adopted management practices used for water quality protection. Grassed waterways, filter or buffer strips, and trees or shrubs were among the management practices removed. Some of these projects were funded with state grants.

Indicators of Aquatic Habitat Improvements -

- Riparian areas can improve water quality by trapping sediment and other pollutants contained in terrestrial runoff (NRC 2002; Flosi and others 1998; Pierce's Disease/Riparian Habitat Workgroup PDRHW 2000; Palone and Todd 1998). intact riparian area helps decrease rate of water flow, stores floodwaters, and dissipates stream energy, increasing infiltration (Palone and Todd 1998).
- The Watershed Institute Division of Science & Environmental Policy at California State University Monterey Bay implemented wetland restoration projects in the Gabilan Watershed and surrounding Southern Monterey Bay Watersheds. These projects increased plant and bird populations and improved water quality (removed sediment, nitrate and pesticides loading to waterbodies).
- Coastal Conservation and Research and Moss Landing Marine Laboratories implemented restoration projects in the Moro Cojo Slough. These projects reduced nitrate levels in runoff, increased plants and vertebrate populations, and supported endangered species.
- The Watershed Institute at California State University Monterey Bay and Moss Landing Marine Laboratories studied changes in stream turbidity in restoration sites in the Hansen Slough area near Watsonville. The study concluded that stream turbidity decreased by more than 50-fold and nitrate concentrations in water flowing through decreased from levels at and above 140 mg/L to levels between 5 mg/L and 40 mg/L.

5. Waste Discharges from Irrigated Agricultural Lands

Water quality of agricultural waste discharges is often poor, carrying nitrates at concentrations above safe drinking water levels and pesticides at concentrations above toxic levels to waterbodies in the region. Agricultural waste discharges contribute significantly to water quality conditions. In some cases, agricultural waste discharges are the sole or primary source of pollution in impaired waterbodies. Even in areas where agricultural is not the only source of pollution, it is a primary contributor.

Numerous studies document the affect of agricultural waste discharges on water quality and specific pollutants contained in irrigation runoff. Research conducted by the Food and Agriculture Organization of the United Nations found that irrigation return flow resulted in a significant increase in nitrogen, phosphorous, pesticide residues, and sediments. Agricultural research conducted by University of California Cooperative Extension (UCCE) found nitrate values in agricultural tailwater at 26, 53, and 75 mg/L NO3-N (up to 7.5 times the drinking water standard). UCCE researchers indicated that the high levels of nitrate at the site were likely caused by the grower injecting nitrogen fertilizer into the irrigation water during the 2nd and 3rd irrigation events. A UC Davis study of Salinas Valley farms found that by the second and third crop cycles, farm soils had begun to accumulate nitrogen, but that growers continued with the same fertilization schedule. In addition, soils are high enough in phosphorus that in some areas no added phosphorus is necessary; however, growers continue to add this chemical to their fields. These practices lead to excess fertilizer leaving the farm, which ultimately cause significant water quality impairment. Similar to tailwater, tile drain water with elevated nitrate levels has been found draining into surface water bodies. Nitrate concentrations in selected waterbodies in the Pajaro Valley Watershed have been found to range from 19 to 89.5 mg/l NO3 as N (compared to the drinking water standard, 10 mg/l).

Pesticides have been detected in agricultural tailwater and routinely exceed the toxicity water quality standard (lethal to aquatic life). Regionwide, CCAMP and the Cooperative Monitoring Program have conducted toxicity monitoring in 80 streams and rivers. Some measure of lethal effect (as opposed to growth or reproduction effect) has been observed at 65 percent of the waterbodies monitored.

D. Summary of Environmental Analysis Pursuant to CEQA

Staff conducted an environmental analysis pursuant to the California Environmental Quality Act (CEQA). The results are summarized below and the documents are included in Appendix H. Cost considerations related to CEQA are contained in Appendix F.

In 2004, the Central Coast Water Board adopted the 2004 Agricultural Order and a Negative Declaration prepared in compliance with CEQA. CEQA Guidelines state that no subsequent environmental impact report (SEIR) shall be prepared when an EIR has been certified or negative declaration adopted for a project unless the lead agency determines based on substantial evidence in light of the whole record, one or more of the following:

> *(1) if substantial changes are proposed in the project which will require major revisions of the previous EIR or negative declaration due to the involvement of new significant environmental effects or a substantial increase in the severity of previously identified effects; or,*
>
> *(2) if substantial changes occur with respect to the circumstances under which the project is undertaken which will require major revisions of the previous EIR or negative declaration due to the involvement of new significant environmental impacts or a substantial increase in the severity of previously identified significant effects; or*
>
> *(3) if new information of substantial importance, which was not known and could not have been known with the exercise of reasonable diligence at the time the previous EIR was certified as complete or the negative declaration was adopted, becomes available.*
>
> (Cal. Code Regs., tit. 14, § 15162(a).)

This regulation applies if there is a modification of a previous project. In this case, the Central Coast Water Board is proposing to renew the 2004 Agricultural Order, which is the previous project, with clarifications and new conditions. To assist in determining whether an SEIR would be necessary, the Central Coast Water Board staff held a CEQA scoping meeting on August 16, 2010 to receive input from interested persons and public agencies on potentially significant environmental effects of the proposed project. Staff also accepted written comments regarding scoping up until August 27, 2010 in order to allow for comments from those who were unable to attend the meeting and/or for those who wished to submit additional comments. Members of the public and representatives of public agencies provided comments regarding their views on significant environmental effects associated with the adoption of a renewed Agricultural Order. Prior to the scoping meeting in August, 2010, and described elsewhere in this staff report and in the Order, significant public participation activities had occurred.

In preparing the Draft SEIR, Central Coast Water Board staff reviewed the 2004 Negative Declaration, including the Initial Study (Environmental Checklist), considered the comments received during the public participation process with respect to renewal of the 2004 Agricultural Order, including evidence in the record, written and oral comments, proposed alternatives, and information provided at and following the August 16, 2010 scoping meeting, and comments received on the Draft SEIR. Review of this information did not result in identification of any new environmental effects that had not already been evaluated in the 2004 Negative Declaration. Staff identified two areas included on the Environmental Checklist where there was a potential for an increase in the severity of environmental effects previously identified. These areas are (1) the potential for more severe impacts on agricultural resources due to the potential for an increase in the use of vegetated buffer strips and economic impacts due to new requirements that could take some land out of direct agricultural use and (2) the potential for more severe impacts on biological resources due to the potential for a reduction in water flows in surface waters.

The Central Coast Water Board issued a Notice of Availability on October 25, 2010 and provided the public with 45 days to submit written comments on the Draft SEIR. The Water Board received 12 written comment letters. Responses to the comments are in Section 7 of the Final SEIR. In response to comments, the Central Coast Water Board staff revised the Draft SEIR and prepared a draft Final SEIR for the Central Coast Water Board's certification. The 2004 Negative Declaration and the Final SEIR constitute the environmental analysis under CEQA for this Order.

With respect to Agricultural Resources, the Final SEIR concludes that adoption of the proposed alternative could result in some economic or social changes but that there was insufficient evidence to conclude that the economic changes would result in adverse physical changes to the environment. Commenters speculated that the economic impacts would be so large as to result in large scale end to agriculture and that land would be sold for other uses that would result in impacts on the environment. No significant information was provided to justify that concern. As described in the Section 2.4 of this Final SEIR, the draft 2011 Agricultural Order would impose additional conditions on approximately 100 to 300 of the estimated 3000 owners or operators currently enrolled in the 2004 Agricultural Order. CEQA states that economic or social effects of a project shall not be treated as significant effects on the environment. (Pub. Res. Code § 21083.) The Final SEIR concludes that due to some new conditions, particularly the requirement that some dischargers may be required to implement vegetated buffer strips, could result in loss of land for agricultural production since the buffer strips would generally not produce crops and some land could be converted to other uses. This impact was found to be less than significant2 and that mitigation could reduce impacts further. The Central Coast Water Board may not generally specify the manner of compliance and therefore, dischargers may choose among many ways to comply with the requirement to control discharges of waste to waters of the state. Even if all dischargers who could be subject to the condition to use vegetated buffers or some other method to control discharges in the draft 2011 Agricultural Order (Tier 3 dischargers) chose to use vegetated buffers or converted to other uses, the total acreage is quite small compared to the total amount of acreage used for farming and was, therefore, found to be less than significant. In addition, since the land would be used as a vegetated buffer to comply with the Order, this would result in beneficial impacts on the environment, not adverse impacts.

With respect to Biological Resources, the Final SEIR concludes that wide scale water conservation could result in lower flows into surface water resulting in impacts on aquatic life. The Central Coast Water Board may not specify the manner of compliance so it has insufficient information to evaluate the extent to which dischargers would choose to use water conservation to comply and to evaluate potential physical changes to the environment that could result. Reduction in toxic runoff may offset impacts due to the reduced flows that could occur. In addition, reduction in water use could result in increased groundwater levels that would also result in more clean water to surface water.

Based on this information, the Final SEIR concludes that the environmental effects associated with the draft 2011 Agricultural Order may be significant with respect to biological resources. However, given the uncertainty associated with evaluating the available information, it is possible that the effects may turn out to be less than significant. In Resolution R3-2011-0006, the Central Coast Water Board has made findings consistent with the CEQA Guidelines (Cal. Code Regs., tit. 14, § 15091) and a statement of overriding considerations (Cal. Code Regs., tit. 14, § 15093) with respect to biological resources.

E. Conclusion

Discharges of waste associated with agricultural discharges (e.g., pesticides, sediment, nutrients) are a major cause of water pollution in the Central Coast region. The water quality impairments are well documented, severe, and widespread. Nearly all beneficial uses of water are affected, and agricultural waste discharges continue to contribute to already significantly impaired water quality and impose certain risks and significant costs to public health, drinking water supplies, aquatic life, and valued water resources. Existing and potential water quality impairment from agricultural discharges takes on added significance and urgency, given the impacts on public health, limited sources of drinking water supplies and proximity of the region's agricultural lands to critical habitat for species of concern.

The Water Board and the regulated community must act to resolve these serious water quality issues and protect water quality and beneficial uses. Without adequate response, the environmental and health affects are likely to become more severe and widespread. Similarly the costs are likely to increase significantly. The environmental, health and cost impacts threaten to significantly affect the future uses of the Central Coast's water resources.

Staff recommends that the Central Coast Water Board adopt the updated Conditional Waiver of Waste Discharge Requirements for Irrigated Agricultural Waste Discharges, Draft Order No. R3-2011-0006. The Draft Order will require landowners and operators of irrigated agricultural lands to 1) control discharges of waste that affect water quality, in a timely manner, in order to meet, or make progress towards meeting, water quality standards and objectives, 2) comply with conditions of waste discharge control through verification monitoring and reporting, and 3) provide accountability and transparency for the public on behalf of public resources.

This Draft Agricultural Order will secure measurable pollutant load reduction to surface water and groundwater in the Central Coast. Adoption and implementation of the Draft Agricultural Order will insure healthier water quality conditions that provide people with safe drinking water and fish and other aquatic organisms with safe habitats in their streams and estuaries.

Exhibit 5

APPENDIX G

Staff Recommendations for Agricultural Order

WATER QUALITY CONDITIONS IN THE CENTRAL COAST REGION RELATED TO AGRICULTURAL DISCHARGES

CENTRAL COAST REGIONAL WATER QUALITY CONTROL BOARD

March 2011

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STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

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State of California

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Michael Thomas, Assistant Executive Officer

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Table of Contents

1.0 Surface Water Quality

The Central Coast Region includes a diverse landscape of agricultural crops, orchards, and vineyards, rapidly expanding urban areas, and many miles of paved roadways. Chemicals applied to the land (including nutrients, pathogens, metals, pesticides, herbicides, petroleum products and others) make their way into drainages, creeks and rivers, and ultimately the ocean. Pesticides and nutrients that are applied to the land are causing serious damage to our Central Coast water resources. Not all pesticide and nutrient pollution originates from agricultural land. However, research projects and monitoring programs have shown high levels of chemicals leaving agricultural areas and entering the waterways of our Region. Our Region's Central Coast Ambient Monitoring Program (CCAMP) data provided evidence of this problem during development of the existing and first regulatory Order for irrigated agricultural discharges in 2004, the Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands (2004 Conditional Waiver). The 2004 Conditional Waiver specified monitoring requirements that led to development of the Cooperative Monitoring Program for Agriculture (CMP).

The CMP has now collected over five years of data from 50 long-term trend monitoring sites in agricultural areas, as well as additional data from a number of follow-up monitoring studies. The CMP has developed several reports, summarizing the findings of the long-term monitoring, as well as of follow-up activities. Some of those findings are summarized in this staff report. Data, documentation, and references supporting those findings are included as part of the administrative record. The data, documentation and references are also available online through our CCAMP Agricultural Wiki (www.ccamp.net/ag) and website (www.ccamp.org).

CCAMP has been in place since 1998, and has collected data from watersheds throughout the Region. CCAMP has also collected monthly trend monitoring data at coastal confluence sites since 2001. CCAMP findings related to agricultural pollutants are summarized in this staff report. More complete documentation of CCAMP information, including references and access to data, charts, related documents and maps, can be reached through the CCAMP Ag wiki or at www.ccamp.org.

In this staff report we combined data from the CMP (2005 – 2009) and CCAMP (1998 – 2009) to develop a comprehensive assessment of water quality in agricultural areas throughout the Region, and evaluated data relative to associated agricultural land use. The CMP focuses monitoring in agricultural areas with impaired waters and CCAMP focuses monitoring in all areas of the Region. We also evaluated both sets of data for evidence of change. Finally, we assessed potential risk of agricultural chemicals impacting the nearshore marine environment, particularly Marine Protected Areas.

1.1 Overall Water Quality Status

We have summarized overall water quality status of all sites monitored through the CCAMP and CMP programs using a multi-metric approach that combines and scores several parameters into a water quality index. The water quality index includes water temperature, un-ionized ammonia, water column chlorophyll *a*, total dissolved solids (TDS), nitrate-nitrite, ortho-phosphorus, turbidity, and dissolved oxygen. We scored each parameter into one of four categories (good condition (light gray), slightly impacted (medium gray), impacted (dark gray) and very impacted (black). White areas are unscored. Sites which have naturally elevated salt concentrations were removed from consideration for TDS. We have created a separate index for toxicity. The rules for scoring are based on percentile ranking relative to water quality criteria or guideline values, and are described in the CCAMP Ag wiki (www.ccamp.net/ag). We have used the same rules to score sites, waterbodies, and watersheds. A map of the water quality index results (scored for small watersheds (HUC12) using federally defined boundaries) is shown in Figure 1. A similar map of the toxicity index can be found on the CCAMP Ag wiki.

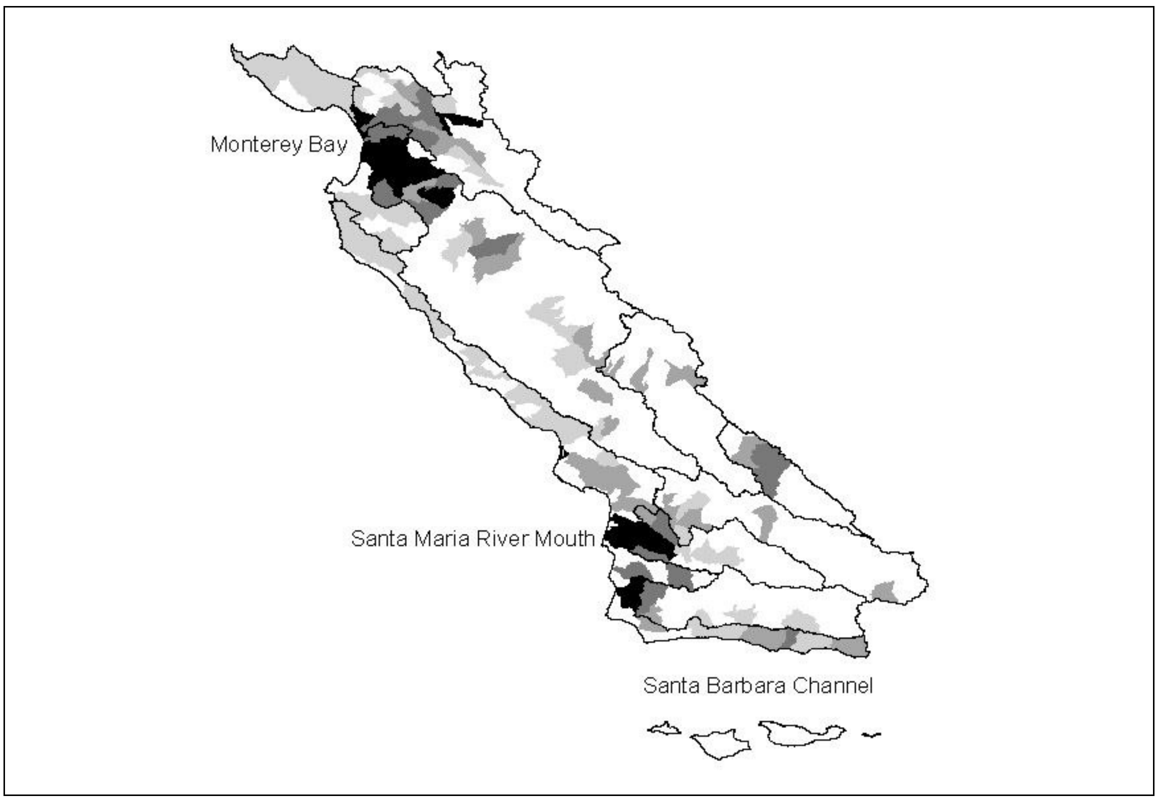


Figure 1. CCAMP Water Quality Index (scored for HUC12 watersheds). Very Impacted areas are shown in black.

These summary indices confirm that two major areas of our region stand out in terms of severity of impact. These are 1) the lower Salinas watershed and tributaries, Tembladero Slough-Salinas Reclamation Canal watershed and Moro Cojo Slough, (hereafter referred to as the “lower Salinas area”) and 2) the lower Santa Maria watershed and tributaries, and lower Oso Flaco Creek (hereinafter referred to as the “lower Santa Maria area”). These are both areas of intensive agricultural activity. We have evaluated the water quality index at 250 individual sites. Of the 51 sites that score worst (less than 40 out of 100 possible points), 82 percent are in these two areas. Similar results are seen for the toxicity index, where all of the worst scoring sites (less than 40 out of 100 points) fall in the lower Santa Maria and Salinas areas (CCAMP, 2010a). Some of the worst quality sites in the Region, Orcutt-Solomon Creek and the Tembladero Slough - Salinas Reclamation Canal, drain directly to sensitive estuarine habitat. Flow and source area follow-up studies by the CMP show that Orcutt Creek flows year-round at relatively high volumes at the lower end of the watershed, with agricultural discharges being the primary source of flow, nitrate, toxicity and sediment. Agricultural discharges contribute significantly to Tembladero Slough - Salinas Reclamation Canal water quality problems both above and below the City of Salinas, though urban loading of nitrate and sediment can be important during winter months. The CMP source areas study identifies several other locations where dominant discharges are from agriculture, as well as some areas where urban discharges and surfacing groundwater are influences (CCWQP, 2008b).

Several other areas in the Region are also in very poor condition. These include the lower Santa Ynez River (heavily influenced by a point source discharge), and the San Juan Creek and Watsonville Slough areas in the Pajaro River watershed (heavily influenced by agricultural activities).

Our 2010 303(d) List of Impaired Waters includes 704 listings for Region 3. This is the list of waters not meeting water quality standards developed every two years pursuant to Section 303(d) of the Clean Water Act. The List is based on a uniform assessment of all data collected through 2006, including data from CMP, CCAMP, and other sources, and it is the most comprehensive evaluation of data conducted in the State for this purpose. Of the 704 impaired waterbody listings in the Central Coast Region, 77 are in the lower Santa Maria area, and include fifteen different pollutants and twelve waterbodies; Orcutt Creek and the Santa Maria River have the most listings. One-hundred and seventeen listings are in the lower Salinas area, with nineteen different pollutants and sixteen waterbodies; the lower Salinas River, the Salinas Reclamation Canal, and Tembladero Slough have the most listings (CCRWQCB, 2009).

1.2 Nitrate Pollution

Nitrate is arguably the most serious and widespread of all pollution problems in the Central Coast Region. The 2010 List of Impaired Waterbodies (CCRWQCB, 2009) includes forty-seven Central Coast waterbodies that have drinking water beneficial uses impaired by nitrate pollution. Sixty-eight percent of these nitrate listings occur in our three major agricultural watersheds: Lower Salinas area (15 waterbodies), Pajaro River watershed (5 waterbodies) and lower Santa Maria area (12 waterbodies). Other notable listings fall in small drainages in areas of intensive agriculture or greenhouse activity along the Santa Barbara coast, including Arroyo Paredon, Franklin, Bell, Los Carneros and Glen Annie creeks. Waterbodies that are listed for nitrate pollution on the 2010 List are shown in Figure 2.

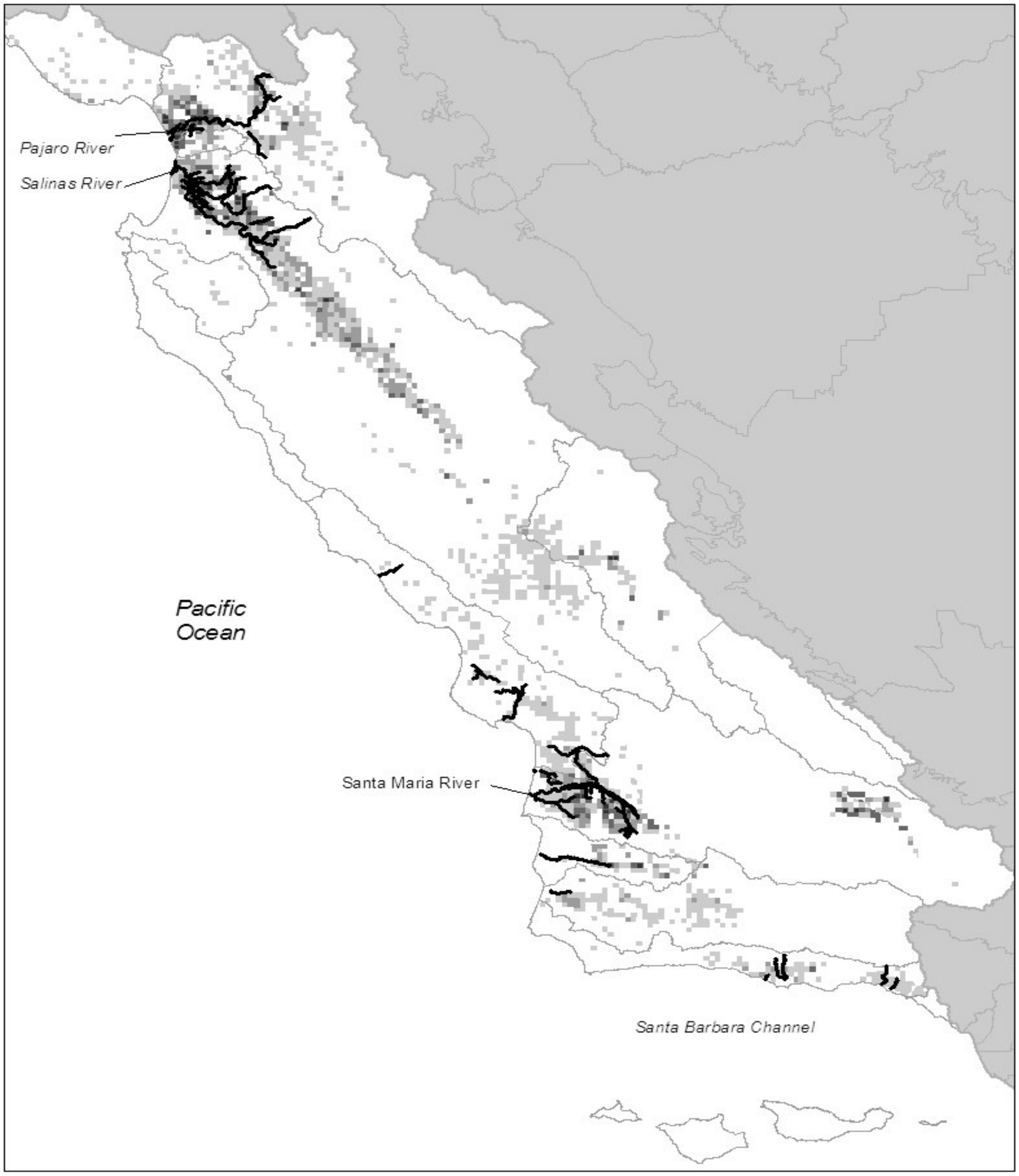


Figure 2. 2010 Nitrate Listings in Region 3. Listed waterbodies are shown as darkened lines, irrigated agriculture is shown in gray tones.

The California Department of Public Health (CDPH) drinking water standard is 10 mg/L nitrate-N. The drinking water standard is not intended to protect aquatic life and staff estimates that 1 mg/L nitrate is necessary to protect aquatic life beneficial uses from biostimulation (Worcester, et al., 2010). Staff used this criterion, along with other evidence of eutrophication, to evaluate surface water quality impairment to aquatic life beneficial uses for the 2010 Impaired Waters List adopted by the State Water Board in August 2010.

Of the 250 sites evaluated for the CCAMP and CMP monitoring programs, fully 30 percent have nitrate-N concentrations that exceed the drinking water standard on average. Several sites have average nitrate concentrations that exceed the standard by five-fold or more. The top twenty worst sites from the standpoint of nitrate contamination have mean concentrations that range from 32.6 to 93.7 mg/L. Staff has determined the acres of row crop agriculture associated with these sites, both in the immediate catchment and in the upstream watershed, based on the National Land Cover Database, 2001. Row crop acreage averages 48.4 percent of the immediate catchment area in which these sites are located, and 27.1 percent of the watershed area upstream of each site. Other land uses can contribute to nitrate concentrations, including orchards and vineyards, greenhouses and nurseries and urban landscapes. However, many of the worst quality sites are in areas dominated by row crop agriculture, either in the near vicinity or in the upstream watershed area (CCAMP, 2010a, 2010b).

Though overall acreage of irrigated agriculture can serve as an indicator of risk for nitrate pollution, it cannot predict locally-scaled impacts. We have observed that even relatively small agricultural operations can greatly influence in-stream nitrate concentrations. In one example, the single intensively irrigated row crop operation on a small watershed was taken out of production in 2006. Nitrate-N concentrations on the creek were typically around 30 mg/L when first sampled by CCAMP in 2002, and have since declined to under the drinking water standard of 10 mg/L (CCAMP, 2010a).

With a few exceptions, most high quality sites (where mean nitrate-N is less than 1.0 mg/L) have wet season nitrate averages that are higher than dry season averages. Increased concentrations in winter may result when rain water moves nutrients off of the land into surface waters. Of the 81 higher quality sites evaluated (mean nitrate-N concentration less than 1.0 mg/L), 80 percent have average dry weather nitrate concentrations that are lower than average wet weather nitrate concentrations. Conversely, most sites with elevated nitrate concentrations (mean nitrate-N greater than 1.0) have dry season averages that are higher than their wet season averages. During the dry season in heavily irrigated areas, agricultural discharges can be a primary source of flow in stream systems. Rain acts to dilute instream concentrations in the wet season. Of the 133 sites with elevated nitrate concentrations, 79 percent have average dry weather nitrate concentrations that are higher than average wet weather nitrate concentrations. Where average concentrations exceed 30 mg/L as N, 89 percent of sites have dry weather concentrations that are higher than wet weather concentrations (CCAMP, 2010a).

We have evidence that urban land uses are contributing less significantly to nitrate concentrations than are surrounding agricultural lands. The City of Salinas is a major urban area permitted for stormwater discharges with a Phase 1 National Pollutant Discharge Elimination System Municipal Permit. The City drains to several waterbodies that are tributary to Tembladero Slough. The Salinas Reclamation Canal travels from agricultural land through the City of Salinas and then back through agricultural land to Tembladero Slough. Concentrations at the downstream end of the City on the Salinas Reclamation Canal are significantly lower (p=0.0013) than concentrations entering the City, and lower than those farther downstream once the drainage travels back through agricultural land (CCAMP, 2010a). However, the City is still a source, and staff have already identified and eliminated one urban discharge with elevated nitrate concentrations.

The San Lorenzo River receives stormwater runoff from one of the Central Coast's larger cities, Santa Cruz. This river also has numerous septic systems in the upper watershed. There is almost no irrigated agriculture in the San Lorenzo watershed. The highest nitrate concentration measured in the San Lorenzo River at its coastal confluence site in almost ten years of monthly monitoring is only 1.4 mg/L nitrate-N. Other urban areas are adjacent to creeks and rivers without causing significant increases in nitrate concentrations. Atascadero, Paso Robles, Cambria, and Carmel are examples. Along the highly urbanized Santa Barbara coast, several sites that are upstream of most urban influence but below intensive agricultural activity show serious nitrate impacts. These include CMP sites on Franklin, Bell, and Glen Annie creeks (CCAMP, 2010a). Other highly urbanized creeks, such as Mission Creek, are less impacted by nitrate (typically under 2.0 mg/L-N). Major urban influences on in-stream nitrate concentrations are primarily associated with wastewater discharges, such as on Chorro Creek, San Luis Obispo Creek and the Santa Ynez River.

1.3 Toxicity and Pesticides

The levels of toxicity found in ambient waters of the Central Coast far exceed anything allowed in permitted point sources discharges. The California Toxics Rule allows only one acute and one chronic toxic test every three years on average for permitted discharges to surface waters. We have drainages in agricultural areas of the Region that are toxic virtually every time they are measured.

CCAMP does not sample for toxicity at all sites, but rather at sites in areas of most intensive land use. Region-wide, CCAMP and the CMP have conducted toxicity monitoring in 80 streams and rivers. In 16 percent of these, no toxic effects were observed. Some measure of lethal effect (as opposed to growth or reproduction) has been observed at 65 percent of the waterbodies monitored.

A number of published studies have already linked invertebrate toxicity in the Central Coast to chlorpyrifos and diazinon in water, and to chlorpyrifos and pyrethroids in sediment (Anderson et al., 2003; Anderson et al., 2006a; Anderson et al., 2006b, Anderson et al., 2010). A summary of toxicity work in the Central Coast Region, and all references can be accessed through the Ag wiki at http://www.ccamp.net/ag/index.php/Main_Page#Toxicity. Staff has used data collected by researchers, by CCAMP and by the CMP to evaluate all Central Coast waters for impairment based on toxicity. As a result, 15 waterbodies are on the 2010 List of

Impaired Waters for both water column and sediment toxicity, and 14 additional waterbodies are on the List for water toxicity alone. The majority of these toxicity listings are in the lower Salinas area (12 listings) and the lower Santa Maria area (10 listings). Seventy-three percent of all toxicity listings and 56 percent of organophosphate pesticide listings are in these two priority areas (CCRWQCB, 2009).

Acute water column toxicity to *Ceriodaphnia* (invertebrate test organism) was found at 50 percent of sites sampled, and 36 percent of all sites were severely toxic (following rules discussed in Section 1.0). Of these severely toxic sites, 90 percent are in the lower Santa Maria and Salinas areas. Fifteen sites have been toxic to invertebrates in water tests nearly every time they are sampled; the vast majority of these (13 sites) are in the lower Salinas area.

CMP conducted follow-up studies at agricultural sites in the lower Salinas and Santa Maria areas to clarify the sources of the extensive water column invertebrate toxicity identified by the program in these two high priority areas (Central Coast Water Quality Preservation, Inc., 2008 and 2010). The follow-up studies and other research have documented a strong relationship between concentrations of diazinon and chlorpyrifos pesticides and water column toxicity in the lower Salinas and Santa Maria areas (CCAMP, 2010a, CCWQP, 2008a; CCWQP, 2009). Diazinon was most commonly elevated in the lower Salinas area, whereas chlorpyrifos was more typically elevated in the lower Santa Maria area. Malathion and methylmyl were also detected at levels sufficient to cause toxicity.

Recent studies on Central Coast lagoons routinely found toxic concentrations of chlorpyrifos in water in the Santa Maria estuary (Hunt et al., 2003, Anderson, et al. 2003; Anderson et al., 2006; Anderson, et al., 2010). A related study supporting TMDL development for the lower Santa Maria area again showed that water toxicity is caused by diazinon and chlorpyrifos and sediment toxicity is likely caused by chlorpyrifos and pyrethroid pesticide mixtures (Phillips, et al., 2010).

A recent USGS study has shown that the breakdown products of chlorpyrifos, diazinon, and malathion are ten to 100 times more toxic to amphibians than the products themselves (Sparling and Fellers, 2007). According to the Department of Pesticide Regulation 2006 Pesticide Use Report, many more pounds of diazinon are applied in Monterey County than in other counties in the Region (or State), particularly to leafy vegetable crops. Chlorpyrifos is applied most heavily to broccoli and wine grapes, in both Monterey and Santa Barbara counties.

Sediment toxicity is also prevalent in agricultural areas of the Region, with 64 percent of all sites sampled showing some toxicity (measured as survival). Twenty of the 23 most toxic sites (where 75% or more of tests are toxic) occur in the lower Salinas and Santa Maria areas (CCAMP, 2010a). Based on several published studies, sediment toxicity appears to be highly related to pyrethroid pesticides and chlorpyrifos, at least in the lower Salinas and Santa Maria areas (Anderson, et al., 2006a, 2006b, 2010; Phillips, et al, 2006). In a comparative study of lagoon water quality, the Santa Maria River lagoon proved to be particularly toxic (Anderson et al., 2010), with persistent toxic concentrations of pyrethroid and organophosphate pesticides and depauperate benthic communities in the lagoon sediments.

The CMP released a draft follow-up report in December, 2010 (CCWQP, 2010d), on sediment chemistry (for organochlorine, organophosphate, and pyrethroid pesticides) and associated toxicity at CMP monitoring sites. This study used measures of toxic units (TUs) to relate chemical concentrations to potential for toxic effects on test organisms. Toxic Units are calculated by dividing the measured concentration of a given chemical by its specific LC50 (the concentration of that particular chemical that kills half the test organisms), and then summing TUs for all chemicals present in the sample. This provides an expression of the "killing power" of the sample. For example, if one chemical is present at two times its LC50, and another chemical is present at 4 times its LC50, the total toxic units of the sample would be 6 TUs. Another way to look at this is if one were to dilute the sample by six-fold, it would still probably be toxic to test organisms.

In the CMP study, organochlorine pesticides, which include legacy pesticides like DDT, were widespread (at 40 of 50 sites) but were found at generally low levels not expected to cause toxicity (with toxic unit sums under 0.1 TUs in all cases). Pyrethroid pesticides were found at 31 sites and chlorpyrifos was found at 20 sites. Most sites had multiple chemicals present, with over half having 10 or more chemicals detected. Chlorpyrifos and pyrethroids were the likely causes of toxicity, with toxicity measured in test organisms in all cases (24 of 46 sites) where the combined toxic units of these chemicals exceeded 0.5 TUs. Chlorpyrifos exceeded 0.5 TUs at 14 sites; pyrethroids exceeded 0.5 TUs at 23 sites. When TUs were examined by pesticide class, pyrethroids had much higher overall TUs than either Chlorpyrifos or OCs.

This study found highest average pyrethroid and chlorpyrifos concentrations in the lower Santa Maria area, where they were detected at all sites. Santa Maria pesticide concentrations averaged more than twice those of Salinas tributaries; the nine Santa Maria area sites averaged 7.5 TUs from pyrethroids and 1.13 TUs from chlorpyrifos. All sites in this watershed were also found to be toxic to test organisms. One site in Santa Maria had the highest pyrethroid levels anywhere, at over 42 TUs, primarily because of bifenthrin. At this site on Bradley Channel, chlorpyrifos was present at 2.7 TUs, also the highest measured anywhere. The second highest average chemical concentrations were found in the Salinas tributaries and Reclamation Canal; the eleven sites there averaged 5.4 TUs of pyrethroids and 0.8 TUs chlorpyrifos. One site on the Reclamation Canal had over 20 TUs of pyrethroids detected. The mainstream Salinas River, San Luis Obispo and Santa Barbara creeks, and the Santa Ynez River had relatively low concentrations overall.

Ng et al. (2008) describes finding significant toxicity in sediments coming out of agricultural land above the City of Salinas, as well as within the City limits, and shows that urban chemical signatures were somewhat different than those from agricultural areas. In a statewide study of four agricultural areas (Salinas, Sacramento, San

Joaquin, and Imperial valleys), conducted by the Department of Pesticide Regulation, the Salinas study area had the highest percent of sites with pyrethroid pesticides detected (85 percent), the highest percent of sites that exceeded levels expected to be toxic (42 percent), and the highest rate (by three-fold) of active ingredients applied (113 lbs/acre) (Starner, 2006). More details on this research, as well as access to the technical papers, can be found at http://www.ccamp.net/ag/index.php/Toxicity_Research_Findings.

Toxicity to algal and fish test organisms is less commonly encountered in the Central Coast Region. Overall, lethal effects for fish were the least frequently encountered toxic effect. Acutely toxic effects to fish were found at 28.5 percent of sites sampled, and 6.5 percent of sites were severely toxic. The CMP found repeated toxicity to fish in several tributaries in the lower Santa Maria area and at several sites along the main stem of the Salinas River, from Greenfield to Spreckels. Several other sites had more than one toxic sample, including Prefumo Creek in San Luis Obispo and Tequisquita Slough in the Pajaro watershed (CCWQP, 2010a).

Toxic effects to algae were found at 44 percent of sites, with 11 percent of sites severely toxic. Toxicity to algae shows a different pattern than most other contaminants staff has examined in this report. In addition to toxicity in the lower Salinas and Santa Maria areas, algal toxicity was also prevalent in some of the Santa Barbara area streams (Glenn Annie, Franklin, Bell), the Pajaro watershed (Furlong Creek, San Juan Creek, lower San Benito River, Pajaro River at Murphy's Crossing, and Harkins and Watsonville sloughs), and in the lower Santa Ynez River. This may suggest other sources than runoff from irrigated agricultural fields, such as roadway maintenance, creek channel clearing, or other activities involving herbicides. CCAMP field staff has observed direct spraying of herbicides on agricultural channels for weed abatement purposes.

The Surface Water Ambient Monitoring Program released a report summarizing the status of water toxicity throughout the State (Hunt, J. and D. Markiewicz, 2010). This summary is to be followed by a more comprehensive report in Spring 2011. The only data used for the Central Coast Region analysis were collected through state funding sources. The more comprehensive report will include more outside data sources, including data collected by the CMP.

The toxicity summary includes data collected under multiple study designs, from Regions with varying problems of concern. As such, sites count varied considerably, ranging from 12 sites in the Lahontan Region, to 298 in the Central Valley Region. The Central Coast Region had 109 water toxicity sites and 86 sediment toxicity sites. Seven percent of all sites sampled statewide were highly toxic. Approximately 35% of samples collected in agricultural areas were highly toxic, compared to approximately 27% in urban areas. In the Central Coast, 22% of all sites were highly toxic in water tests; this was the highest percentage of any region. The next highest percentage was from Region 7 (Colorado River), where 12.5% of all samples were highly toxic. Only 2.3% of Central Valley sites were highly toxic. In the Central Coast, 12.8% of sediment tests were highly toxic; both the San Francisco (R2) and Los Angeles (R4) Regions had over

20% of sites toxic to sediment. Higher sediment toxicity in urban areas may reflect the growing use of pyrethroids, since diazinon and chlropyrifos have been banned for most urban uses.

1.4 Other Parameters of Concern

Turbidity - Turbidity in a healthy creek system in the Central Coast Region is typically very low during the dry season (under 5 NTU), and though it can be elevated during rain events it typically drops back down to low flow conditions relatively rapidly. Waters that exceed 25 NTUs can reduce feeding ability in trout (Sigler et al., 1984). Elevated turbidity during the dry season is an important measure of discharge across bare soil, and thus can serve as an indicator of systems with heavy tailwater discharge. Many of the sampling sites in areas dominated by agricultural activities have sustained turbidity throughout the dry season, in some cases greatly exceeding 100 NTU as a median (CCAMP, 2010a).

CCAMP staff evaluated whether sustained problems were present at monitoring sites using median turbidity values. Ninety-three percent of all sites with a median turbidity value exceeding 100 NTUs were in the lower Salinas and Santa Maria areas. For reference, a majority of CCAMP sites have a median turbidity under 5 NTUs (CCAMP, 2010a).

Water temperature – Water temperature becomes elevated when creeks are not adequately shaded and solar exposure is high. Low flow and wide sandy stream bottoms also contribute to water heating. Twenty-one degrees Celsius is considered at the upper end of the optimal range to support steelhead trout (Moyle, 1976). Though water temperature is problematic in many of the same areas of the lower Salinas and Santa Maria as other parameters examined, there are several additional areas of concern. These include the lower Santa Ynez and tributaries, middle reaches of the Salinas watershed, and several smaller creek systems like Huasna, Jalama and San Lorenzo Creek (CCAMP, 2010a).

Riparian cover helps maintain water temperatures. As an example, Orcutt Creek has lost most of its shading in its lower reaches as a result of channel modification in agricultural areas. It is one of the many waterbodies that are listed as impaired by high temperatures on the 2010 303(d) List of Impaired Waters. Unlike some small drainages, flows remain relatively high (typically ranging between 4 and 10 cubic foot/second (cfs)) through the summer (CCWQP, 2009f). Agricultural discharges to the creek are commonly observed by field staff in this reach. In spite of higher flow, temperatures frequently range between 20 and 25^{o}C in summer months. Upstream, where vegetation is still intact (312ORB) but flow is lower (with baseflow usually less than 1 cfs), temperatures typically remain under 20^{o}C. Similarly, in the next major watershed to the south, temperatures on lower San Antonio Creek typically stay below 20^{o}C in spite of much lower instream flow. The riparian corridor on San Antonio creek is mature and intact (CCAMP, 2010a).

Ammonia - Water quality impairment associated with ammonia is not as widespread in the Central Coast Region as is that associated with nitrate. However, when ammonia is elevated it can be extremely toxic to fish, particularly to salmonids, and thus is of considerable concern. Un-ionized ammonia is the most toxic form of ammonia; it increases in concentration relative to ammonium as pH and temperature increases. The general objective for un-ionized ammonia in the Central Coast Water Quality Control Plan is set at a level that is protective of salmonid populations (EPA, 1999). All but two of the 26 sites most impaired by un-ionized ammonia are in the lower Salinas and Santa Maria areas. Nineteen waterbodies are listed as impaired because of elevated un-ionized ammonia concentrations; the majority of these sites are located in the lower Santa Maria (7 listings) and lower Salinas (8 listings), in areas heavily impacted by agriculture (CCWQCB, 2009).

1.5 Water Quality Trends

Time is required to show change in environmental data, because of the inherent variability in the environment, seasonality, and because changes in land management do not necessarily result in immediate water quality change. Both CWP and CCAMP are designed to allow for detection of statistical trends over time. Both programs monitor fixed sites on a monthly basis. This design provides sufficient sample size to eventually allow for trend detection, although it can take five or more years to show change, depending on the variability of the data and the amount of change. However, we have been able to show statistically significant change at a number of sites.

The CCWQP has completed an analysis of trends associated with CMP data. They employed a non-parametric approach that evaluates data for overall trends and for trends in dry and wet season data. They found that 18 of 27 sites in the lower Salinas and Santa Maria areas showed statistically significant decreases in dry season flow over the first five years of the program. Though flow can be impacted by drought and water diversion, most of these sites are in areas heavily influenced by irrigated agriculture, so it is likely that these trends have been influenced to some degree by changes in agricultural tail water volume or other discharges (CCWQP, 2009a). Changes in flow volume need to be taken into consideration when evaluating trends in concentration.

The CMP analysis showed two sites in the lower Santa Maria area with significant improvements in nitrate concentration (Green Valley Creek (312GVS) and Oso Flaco Creek (312OFC)). Both of these sites also showed declining flow, implying a load reduction has occurred. The CMP analysis also found that concentrations at two sites were getting worse (Natividad Creek (309NAD) in both wet and dry seasons and Salinas River at Chualar Bridge (309SAC) during the wet season only).

The CMP analysis also evaluated turbidity for change. In pristine systems, elevated turbidity is typical only during rain events. In some of the sites heavily dominated by tail water, turbidity is elevated throughout the summer. Four sites on the main stem of the Salinas River (from Greenfield to Spreckels) were identified with significant increasing trends in turbidity during the dry season. Decreasing turbidity trends were noted at sites on Main Street Canal and Bradley Channel in the Santa Maria watershed.

CCAMP has evaluated change through the winter of 2010 using two approaches, including a simple two group comparison (t-test) with transformations to address non-normal data distributions, and a Mann-Kendall trend test. A number of sites show change over the period of time they have been sampled. It should be noted that with short time frames (less than five years) an apparent change can be very dependent on weather or other localized conditions and we have more confidence in changes when we have more years of data. Changes identified below have been confirmed by both statistical tests.

The most notable area-wide improvements in nitrate concentrations are occurring along the Santa Barbara coastline. A number of drainages monitored there are showing statistically significant improving trends, including three with significant agricultural influence (Bell, Glen Annie and Franklin creeks). Other sites that are improving and that have considerable agricultural influence include Chualar Creek, San Antonio Creek. Pacheco Creek, Chorro Creek, and Prefumo Creek. It should be noted that discharges to Chorro Creek have improved recently due to upgrade of the California Men's Colony treatment plant that discharges to the creek. Franklin Creek improvements began following Regional Board regulatory action associated with greenhouse discharges in 2002. Improvements on the Prefumo Creek drainage followed cessation of agricultural activity on land awaiting urban development. Nitrate changes on these creeks are likely impacted by these actions.

When change is evaluated for flow-weighted nitrate (nitrate concentration times flow), several other sites show statistical declines. These include Quail Creek, Prefumo Creek, Green Valley Creek, Blanco Drain and Espinosa Slough. Of these, only Prefumo Creek also shows significant decreases in concentration.

Our analysis of nitrate data indicates that a number of the sites that are in very poor condition in terms of nitrate concentrations are getting worse, not better. Most of these sites are located in the lower Salinas and Santa Maria areas (Old Salinas River, Orcutt Creek (at three sites), Santa Maria River mouth), which are our high priority areas for TMDL development. Increases have also been seen on Arroyo Grande Creek in areas influenced by agricultural discharge. We have not detected any instances where flow-weighted nitrate is increasing.

Because toxicity is sampled less frequently than other parameters through the CMP, statistical change in toxicity is less likely to be detected than in conventional parameters. The Salinas Reclamation Canal at Jon Rd. shows statistically significant improvement in invertebrate survival in water. A few other sites show indications of improvement, including Espinosa Slough. The Espinosa Slough site has extremely toxic sediment, and diminishing toxicity in water may reflect a change from use of soluble organophosphate pesticides like diazinon to less soluble pesticides like pyrethroids (which are more toxic in sediment). Toxicity to fish appears to be getting worse on the Salinas River at Gonzalez, and improving on the Santa Ynez River above Lompoc. Algal toxicity appears to be improving at a few sites, including the lower San Benito River and lower Orcutt Creek. These changes can be verified as sample count increases.

1.6 Habitat and Stream Biota

The National Clean Water Act requires that water quality standards protect the physical, chemical, and biological integrity of our Nation's waters. State Water Resources Control Board programs are moving aggressively towards adopting biocriteria for regulatory use in permits issued throughout the State. Biocriteria will include numeric requirements for maintenance of the invertebrate communities that dwell in stream bottom substrate. Though biocriteria will not be established state-wide until 2013 or later, invertebrate metrics from impacted areas can still be compared to metrics in relatively clean locations to assess overall condition. The species composition within invertebrate communities reflects comprehensive stream health, both in terms of habitat quality and water quality. Both the CCAMP and CMP programs have collected benthic macro-invertebrate data as part of their monitoring programs. This data collection includes a detailed analysis of habitat at the monitoring site. Because sites are selected for ease of access, habitat scores are not necessarily reflective of all habitats in the sampled area, but can still give an indication of local conditions.

High quality sites monitored by CCAMP (including sites in upper Big Sur River, Big Creek, upper San Simeon Creek and Arroyo de la Cruz) typically have high overall diversity (with more than forty taxa in a sample), and numerous "EPT" taxa (which are considered sensitive to water and habitat quality and include the mayfly (Ephemeroptera), stonefly (Plecoptera) and caddisfly (Trichoptera) groups). Additional characteristics of these high quality sites include excellent water quality and stable, diverse habitat (well established and mature riparian corridor and in-stream habitat with a mix of substrates including gravel, cobble and woody debris).

Benthic macro-invertebrate community composition reflects poor water quality and lack of habitat at sites in areas with heavy irrigated agricultural activity. See Table 1 for a comparison of these sites to sites farther upstream and to high quality sites. In the lower Salinas and lower Santa Maria areas common measures of benthic macro-invertebrate community health and habitat health score low, especially compared to upper watershed monitoring sites and other high quality sites in the Central Coast Region. Overall taxa diversity is much lower, EPT taxa are completely absent from many sites, and substrate is dominated by sand or fines with little or no boulders, cobbles or gravels. Percent canopy cover is low and the riparian habitat typically does not have a diverse structure that includes woody vegetation and understory (CCWQP,2009b; CCWQP,2009c; CCWQP,2009d ; CCWQP, 2009e; CCAMP, 2010 a).

Upper Salinas and Santa Maria watershed sites are more similar to highest quality CCAMP sites, with diverse benthic communities and relatively high numbers of EPT taxa. Habitat at upper watershed sites is also in better condition with a greater diversity of substrates including a mix of sand, gravel and cobbles. The riparian corridor is typically well established, with mature trees and understory vegetation at all sites.

These findings indicate that streams in areas of heavy agricultural use are typically in poor condition in terms of benthic community health and that habitat in these areas is often poorly shaded, lacking woody vegetation, and heavily dominated by fine sediment. Invertebrate community composition is sensitive to degradation in both habitat and water quality. In some cases, the fine sediment dominating stream substrate is likely the largest influence on benthic community composition, but in areas where sediment and water toxicity is common, chemical impacts to the native communities are also probable. Heavily sedimented stream bottoms can result from the immediate discharge of sediment from nearby fields, the loss of stable, vegetated stream bank habitat, the channelization of streams and consequent loss of floodplain, as well as from upstream sources.

	Total Taxa Diversity	EPT Taxa Diversity	Instream Substrate	Riparian Canopy
Highest Quality Sites	> 40	> 20	Mixed gravel, cobble, woody debris	Mature trees with understory
Lower Salinas area	3 - 27, with one exception	0 - 6	> 90% sand and fine sediment	Typically (for 8 of 13 sites) < 5% canopy cover, dominated by non-woody plants
Lower Santa Maria watershed	6 - 16, with one exception	0	> 85% sand and fine sediment	Typically < 10 % canopy cover, dominated by non-woody plants
Upper Salinas watershed	26 - 43	6 - 17	Mixed sand, gravel, cobble	Mature trees with understory
Upper Santa Maria watershed	25 - 44	5 - 18	<25% fines, dominated by gravel and cobble	Mature trees with understory

Table 1. Summary of typical biological and habitat conditions at high quality sites, and at sites in the lower and upper Salinas and Santa Maria watersheds.

1.7 Impacts and Potential Impacts of Agricultural Pollutants on the Marine Environment

A number of monitoring and research efforts over the years have shown that chemicals leaving the land can cause environmental impacts in the marine environment. For example, the Central Coast Long-term Environmental Assessment Network (CCLEAN) has shown that concentrations of dieldrin in the open ocean at times exceed Ocean Plan objectives, dieldrin concentrations in mussels collected along the shoreline can exceed OEHHA Human Health alert levels, concentrations of dieldrin in offshore sediments at times exceed NOAA Effects Range Low concentrations, and concentrations of dieldrin leaving Pajaro and Salinas Rivers can exceed California Toxics Rule criteria (CCLEAN, 2007). Dieldrin was a chemical used widely in agricultural applications from 1950 - 1974, but also in termite and mosquito control up into the early 1980s. It has been banned for many years because of its bioaccumulating properties. Nevertheless, it is clearly still impacting the nearshore ocean environment in measurable ways.

There are other examples of chemicals formerly used in agricultural applications being found in nearshore areas. For example, Dugan (2005) found significant concentrations of DDT in sand crab tissues along the shoreline off of the Santa Maria river mouth, with concentrations declining with distance from the river mouth. Granite Canyon Marine Pollution Studies Laboratory researchers (Anderson et al., 2006, 2010) found elevated levels of DDT and more currently applied agricultural chemicals in the lower Santa Maria river and its estuary, along with significant invertebrate toxicity and impoverished benthic communities, and tracked high levels of agricultural chemicals moving from stream discharges into the lagoon. Moss Landing Harbor is listed as a Toxic Hot Spot because of high levels of legacy chemicals that have entered from upstream sources primarily the Salinas Reclamation Canal – Tembladero Slough watershed. The drainages that enter Moss Landing Harbor are some of the most polluted in our Region, with documented toxicity and chemical pollution from nitrates and pesticides that originate, at least in great extent, from the intensive agricultural activities in the area.

Most currently applied chemicals are not known to bioaccumulate in tissue the way that some of the legacy pesticides have. However, some pesticides, such as pyrethroids, are known to attach to sediments and persist in a relatively stable form in the aquatic environment where they can cause sediment toxicity. It is not unreasonable to expect that in some areas, particularly where fine sediments accumulate, they may cause impacts to marine life.

1.8 Risk to Marine Protected Areas

The first Marine Protected Areas designated for the State of California are located along the central coast of California (Figure 3). Many of these are located in relatively remote areas, such as along Big Sur coastline. However, several are located in areas that are more likely to be impacted by sediment and water discharges leaving our river mouths. Three of the MPAs, Elkhorn Slough, Moro Cojo Slough and Morro Bay, are estuaries that receive river runoff into relatively enclosed systems.

Staff has identified and ranked the eight MPA areas most likely to be impacted by agricultural chemicals in Table 2. This ranking, although qualitative, is based on technical data and associated models related to MPA proximity to polluted discharges and size of discharge. Other MPAs, because of their locations offshore of smaller, more remote watersheds, are all considered to be at low risk for impacts from agriculture. Staff has described some of the risks for individual MPAs in more detail on the CCAMP

Ag wiki. For example, for Moro Cojo Slough and Elkhorn Slough, nitrate, pesticides and toxicity are documented problems. These two MPAs are already included as part of the Moss Landing Toxic Hot Spot designation (BPTCP, 1998).

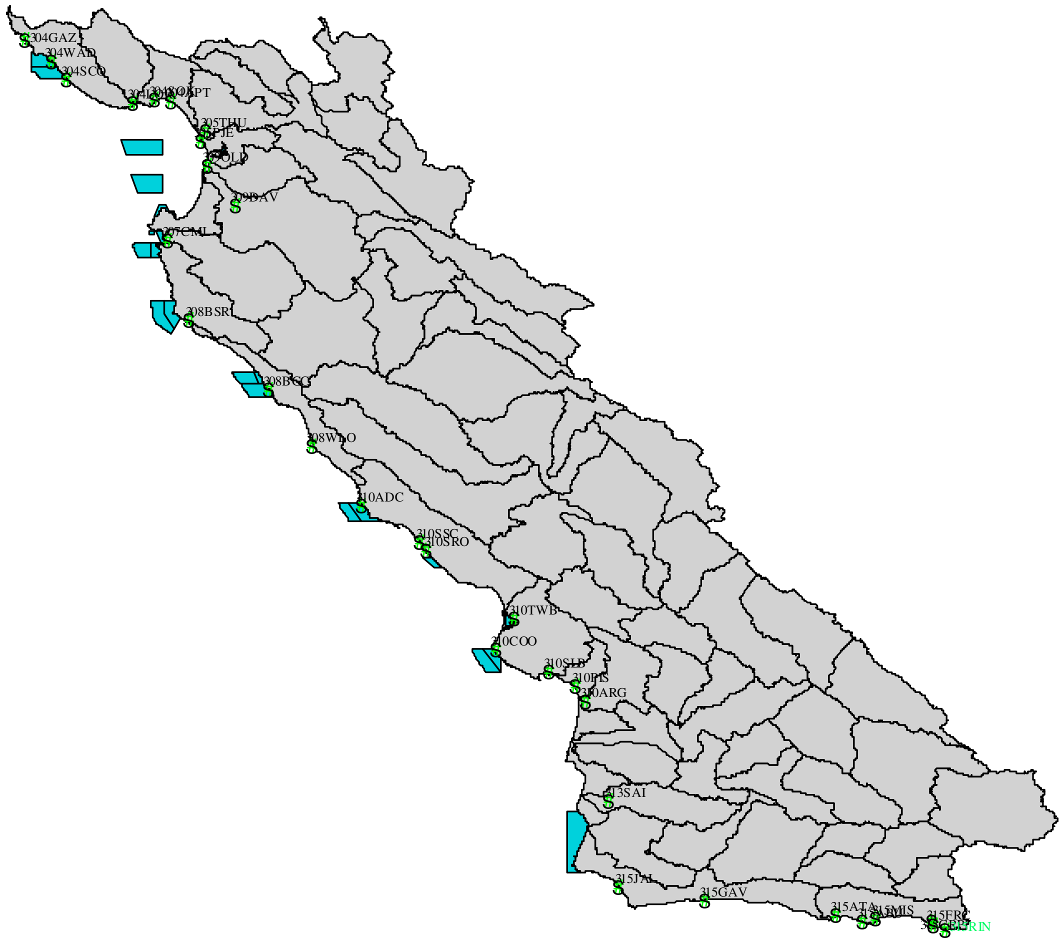


Figure 3. Marine Protected Areas and CCAMP coastal confluence monitoring sites in the Central Coast Region.

<u>Nutrients</u> - Current research indicates that nutrient discharges from rivers may be important drivers of toxic plankton blooms during periods when ocean upwelling is not dominant. Toxic phytoplankton blooms appear to be increasing in frequency and possibly in toxicity over the years, and researchers are evaluating whether anthropogenic sources of nutrients from rivers and wastewater could be contributing to this increase. Recent research shows that *Pseudo-nitzschia* blooms and the toxicity of those blooms can vary according to nitrogen availability.

CCAMP staff has developed estimates of loading to the ocean using nitrate concentration data along with modeled daily flow discharges from coastal confluence monitoring sites. We have provided CCAMP discharge and loading data over a ten-year period (2000 – 2009) to U.C. Santa Cruz researchers, who have evaluated the effects of river and wastewater sources relative to upwelling on daily and weekly time scales in the Monterey Bay area (Lane, 2009; Lane, et al., in review). This research shows a clear onshore to offshore gradient in nitrate load influence from rivers, and also shows overall increasing trends in loading from rivers, whereas nitrate loading from upwelling shows no trends. Also, the ratios of nitrate to other nutrients coming from the Pajaro and Salinas areas are extreme when compared to other sources in the area (other streams and rivers, upwelling, wastewater) and other rivers. As an example, the Mississippi River has a nitrogen:phosphorus ratio of 15. The Salinas ratio is over 3000. Ninety-five percent of loading to the Bay comes from the Pajaro and Salinas systems. The study estimates that inland surface water nitrate loading has exceeded that of wind-driven upwelling in 28% of daily load estimates within the study period. This work suggests that nutrient discharges from inland surface waters can increase the initiation and development of phytoplankton blooms in the Monterey Bay area.

Researchers at the Monterey Bay Aquarium Research Institute have documented plankton bloom initiation two years in a row (2007 and 2008) in lower salinity waters directly adjacent to the nutrient enriched Moss Landing (Chapin et al., 2004) and Pajaro River discharges (Lane, 2009; Lane, et al., in review), following first flush events. These blooms have then evolved into very large red tides, particularly in 2007 (Ryan J., 2009). This red tide killed hundreds of sea birds in the affected area (Jessup, et al, 2009).

The Moro Cojo and Elkhorn Slough MPAs are directly impacted by nitrate, which in Moro Cojo Slough in particular is present at levels far above those that are protective of aquatic life. Other MPAs are likely to be impacted by nitrate indirectly, for example by increased frequency of toxic algal blooms.

Pesticides - Any pesticide that enters the marine environment is capable of having an effect on some aspect of the environment. However, pesticides that attach to sediments (such as pyrethroids and chlorpyrifos) represent the highest risk for impact, because fine-grained sediments can accumulate in specific areas as a result of current and wave patterns. The intense mixing that occurs in the marine environment will quickly dilute more soluble chemicals and greatly reduce their concentrations once they leave the vicinity of the shoreline. U.C. Berkeley scientists conducted a screening evaluation of CCLEAN sediment samples for pyrethroid pesticides. These samples are located along the 80-meter contour in the Bay where fine sediments tend to accumulate. No pyrethroids were detected in these samples, implying that these chemicals may not impact Monterey area MPAs that are located farther from the shoreline.

Pesticides directly impact the Moro Cojo and Elkhorn Slough MPAs. Moro Cojo Slough sediment has been toxic to test organisms on more than one occasion, and Elkhorn Slough receives daily tidal inputs from the Old Salinas River and Tembladero Slough, which are toxic to invertebrates during most sampling events. The highest pounds of some pyrethroid chemicals in the State are applied in Monterey County (Starner, et al., 2006). Toxicity testing and Toxicity Identification Evaluations conducted in this area have shown that pyrethroids are causing sediment toxicity. We have ranked MPAs in the vicinity of Moss Landing at a high level of risk compared to MPAs in more pristine areas.

MPA	Severity of agricultural discharge	Proximity of MPA to discharge plume(s)	Size of discharge	Overall Risk from Agriculture
1. Moro Cojo Slough	Extremely High	Extremely High	Low	Extremely High
2. Elkhorn Slough	Very High	Extremely High	Medium	Very high
3. South Santa Ynez River mouth	Medium	High	Medium	Medium
4. Monterey Bay (two MPAs)	Very High	Very Low	High	Medium
5. Morro Bay	Low	Very High	Low-Medium	Low-Medium
6. Carmel River	Low	High	Medium	Low
7. Pacific Grove	Low	Low	Low	Low

Table 2. Marine Protected Areas most likely to be impacted by agricultural discharges

1.9 Conclusions

Staff has examined a large amount of data from both CCAMP and the CMP. We have found that many of the same areas that showed serious contamination from agricultural pollutants five years ago, particularly nitrate and toxic pesticides, are still seriously contaminated. We have seen evidence of improving trends in some parameters in some areas. Dry season flow volume appears to be declining in many areas of intensive agriculture. However, we are not seeing widespread improvements in nitrate concentrations in areas that are most heavily impacted, and in fact a number of sites in the lower Salinas and Santa Maria areas appear to be getting worse, at least in terms of concentration. Invertebrate toxicity remains common in both water and sediment. Statistical trends in toxicity are not yet typically apparent, in part because of smaller sample sizes, but a few sites show indications of improvement. Persistent summer turbidity in many agricultural areas implies that water is being discharged over bare soil and is moving that soil into creek systems. Dry season turbidity is getting worse along the main stem of the Salinas River. High turbidity limits the ability of fish to feed. Bioassessment data shows that creeks in areas of intensive agricultural activity have impaired benthic communities, with reduced diversity and few sensitive species. Associated habitat is often poorly shaded and has in-stream substrate dominated by fine sediment. In general, staff finds poor water quality, biological and physical conditions in many waterbodies located in, or affected by, agricultural areas in the Central Coast Region.

2.0 Groundwater Quality

2.1 Introduction

In the Central Coast Region (Region), groundwater accounts for approximately 83 percent of the water supply used for agricultural, industrial, and municipal (urban) purposes and nearly 100 percent for rural domestic purposes. In some groundwater basins in the Region, groundwater accounts for nearly all of the water supply. Consequently the protection and restoration of the beneficial uses of groundwater is essential for the environmental and economic vitality of the Region as it relates to the sustainable use of water resources. Moreover, groundwater protection and restoration is paramount to the availability of pure and safe drinking water for every citizen[1] and for the protection of public health. Once the beneficial uses of groundwater are impaired, it takes a very long time (years, decades or possibly even centuries) to clean up and the impairments often result in long-term societal costs. Therefore, source control of pollutants is essential for the protection and restoration of the beneficial uses of groundwater for future generations.

There are numerous localized and generally well-known groundwater impacts in the Region caused by point sources of contaminants/waste from wastewater treatment/reclamation facility and septic system discharges, leaking underground storage tanks (UST), chemical spills, land disposal facilities and Department of Defense (DoD) facilities. Active oversight of these point sources is ongoing via various State and Regional Water Quality Control Board regulatory programs such as the Waste Discharge Requirements (aka, Non Chapter 15, Core Regulatory or Point Source Permitting), UST, Site Cleanup, Land Disposal and DoD programs. The responsible parties (inclusive of both dischargers and property owners) for these point sources of waste discharges are subject to regulatory requirements such as effluent limitations (both mass and concentration based), treatment standards and operational requirements, site investigation and cleanup (including source reduction/control and remediation), compliance monitoring and reporting, and the provision of replacement water supply for impacted beneficial uses. Point source responsible parties are also subject to enforcement actions including cleanup and abatement, cease and desist, and administrative civil liability orders for non-compliance with applicable orders and regulations and for discharges of waste to waters of the State.

Regional evaluations of available data indicate the largest and most severe impacts to groundwater, particularly drinking water beneficial use impacts, in the Region are from widespread nonpoint source nitrogen (primarily in the form of nitrate) discharges. In the Region, state drinking water standards are exceeded for nitrate in public supply wells more frequently than any other constituent or group of constituents. A Department of Water Resources (DWR) survey of groundwater quality data collected between 1994 and 2000 from 711 public supply wells in the Central Coast hydrologic unit found that 55

[1] Section 116270(a) of the California Health and Safety Code states, "Every citizen of California has the right to pure and safe drinking water."

percent of the drinking water standard violations were attributable to nitrate, with inorganic constituents a distant second at 17 percent.[2] Pesticides were attributable to five percent of the drinking water standard violations. Based on these data, approximately 9.4 percent of all public water supply wells in the Region were impacted with nitrate in excess of the drinking water standard between 1994 and 2000. An evaluation of public water supply well data on a sub-regional basis up to 2009, as will be discussed in subsequent sections of this report, indicates even higher incidences of nitrate impacted groundwater supplies around and within areas subject to intensive agricultural land use.

National studies by the U.S. Geological Survey (USGS) indicate that on a regional basis agricultural crop production provides the largest source of nitrate loading to water resources, including groundwater.[3] According to the California Department of Food and Agriculture (CDFA), the Central Coast valleys are major vegetable producing areas and that in this region irrigated vegetable fields are a potential source of groundwater contamination. The five major crops grown in the Central Coast, lettuce, broccoli, cauliflower, celery and strawberries, account for 41 percent of the vegetable acreage in California excluding processing tomatoes.[4] Analyses contained within subsequent sections of this report clearly indicate that fertilizer is by far the largest source of nitrogen input within the Region and that it is the largest source of nitrate loading to groundwater within areas subject to intensive irrigated agricultural land use. Nitrogen loading to groundwater from the application of fertilizer-nitrogen and associated irrigated agricultural practices causing the loading are currently unregulated.

Since 1988 the Monterey County Water Resources Agency (formerly the Monterey County Flood Control and Water Conservation District) has conducted a number of groundwater quality studies and authored numerous reports documenting the nitrate problem in the Salinas Valley as it relates to irrigated agriculture. Available groundwater quality data indicate the Salinas Valley groundwater basin, underlying the most extensive and concentrated irrigated agricultural land use within the Region, is subject to the most widespread and severe nitrate impacts in the Region. A 1978 study documented the severity of nitrate and salt impacts to the Salinas Valley and Pajaro Valley groundwater basins and indicated that agricultural crop production was the leading source of nitrogen/nitrate and salt loading to these basins.[5] This analysis remains true today and ongoing groundwater quality monitoring by the Monterey County Water Resources Agency (MCWRA) and Pajaro Valley Water Management Agency (PVWMA) indicates the nitrate problem is growing more severe. Salinas Valley Integrated Regional Water Management Plan documents also identify nitrate

[2] Department of Water Resources, California's Water, Bulletin 118, Update 2003
[3] U.S. Geological Survey, National Ambient Water Quality Assessment program, http://water.usgs.gov/nawqa/
[4] California Department of Food and Agriculture website; http://www.cdfa.ca.gov/is/fflders/about_fertilizer.html
[5] Association of Monterey Bay Area Governments (AMBAG), October 1978. "Investigation of Nonpoint Source of Groundwater Pollutants in Santa Cruz and Monterey Counties, California." H. Esmaili and Associates

contamination and seawater intrusion as the two most significant groundwater quality problems within the Salinas Valley.[6]

Nitrate impacts in the Llagas subbasin (Gilroy and Morgan Hill area) are also well documented. According to reports by the Santa Clara Valley Water District (SCVWD), nitrate impacts the largest number of wells in Santa Clara County, with the highest incidence of impacts occurring in the Llagas subbain,[7] and that of various sources of nitrogen loading to groundwater the highest loading comes from the application and associated discharge/leaching of agricultural fertilizers.[8] In addition, a 2005 Lawrence Livermore National Laboratory (LLNL) study that used multiple analytical and isotopic techniques concluded that inorganic [chemical] fertilizer is the main source of nitrate within shallow groundwater in the Llagas subbasin.[9]

To a much lesser extent, nitrate impacts to groundwater and water supply systems are also documented in smaller and more localized areas subject to irrigated agricultural such as Watsonville/Pajaro, Morro Bay, Arroyo Grande, Santa Maria, Nipomo, Santa Inez, San Juan Bautista and Hollister areas. Although regional groundwater data is publicly unavailable, limited or completely lacking for various smaller regional areas subject to intensive agricultural land use, the level and extent of nitrate impacts to groundwater underlying these areas is likely commensurate with the level of agricultural activity and aquifer susceptibility. This presumption is based on an evaluation of available data for these areas and a preponderance of evidence documenting nitrate impacts from irrigated agriculture in other areas where more extensive data is available.

Although a limited body of data indicates irrigated agriculture is likely responsible for widespread leaching of salts and other chemicals such as pesticides with the potential to impact drinking water beneficial uses, this report focuses primarily on nitrate. This is because available groundwater and water supply quality data show a widespread and immediate threat to public health from nitrate impacted groundwater in areas of intensive irrigated agricultural activity. Whereas groundwater quality and loading data/studies are generally available for nitrate, lesser data is available for salts in general or pesticides, and the link to public health threats from these is less clear. As more data become available, salt loading to groundwater within agricultural areas may prove to be a bigger long-term problem with the potential to make entire groundwater basins unusable as a source of municipal, industrial and agricultural supply without the removal of salts.

Agricultural Land Use in the Central Coast Region

[6] RMC Water and Environment, May 2006, *Salinas Valley Integrated Regional Water Management Functionally Equivalent Plan Update*; Submitted for: Proposition 50, Chapter 8, Implementation Grant Application. http://www.mpwmd.dst.ca.us/Mbay_IRWM/IRWM_library/Salinas_Valley_FEP_May_2006.pdf

[7] Santa Clara Valley Water District, March 2010, 2009 Groundwater Quality Report.

[8] Santa Clara Valley Water District, 1996. Llagas Groundwater Basin Nitrate Study: Final Report

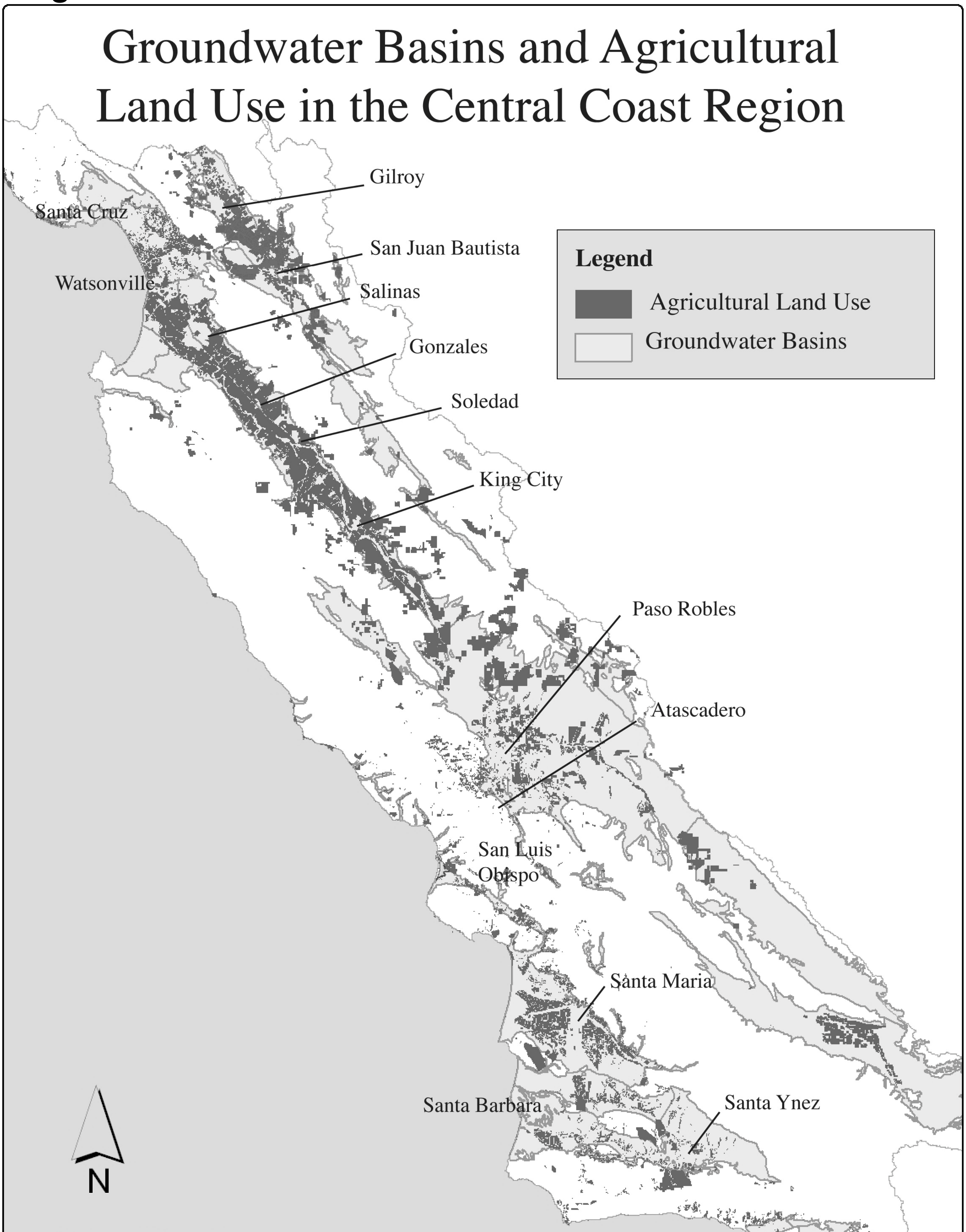
[9] LLNL, 2005. California GAMA Program: Sources and Transport of nitrate in shallow groundwater in the Llagas Basin of Santa Clara County, California. UCRL-TR-213705

The location and extent of agricultural land use, and irrigated agriculture in particular, in the Central Coast Region is an important factor to consider in evaluating the potential sources, locations and areal extent of nitrate loading to groundwater from fertilizer application. Available groundwater data indicate the highest level of nitrate impacts in areas of intensive irrigated agriculture. Whereas point source nitrogen discharges to groundwater occur on localized scales of aerial loading covering square feet or acres that impact limited and definable portions of groundwater basins, nonpoint source nitrogen discharges from irrigated agriculture as a result of fertilizer application occur on regional scales of loading covering thousands of acres or square miles. Nitrate loading on this scale has been shown to impact major portions of entire groundwater basins.

Agriculture comprises a significant proportion of land use over many of the Region's groundwater basins. Next to open space and undeveloped land, agriculture is the predominant land use within portions of the Region as shown in Figure 2.1. Agricultural land use is the most extensive and concentrated over portions of the Salinas Valley groundwater basin. For example, land use in the Salinas Valley is approximately 63 percent farmland (approximately 214,190 acres), 7 percent urban and built-up with the remaining 30 percent open space. Land use in the Santa Maria Valley is about 25 to 30 percent farmland with approximately 51,417 acres of irrigated acreage.[10] Approximately 41 percent of the land use overlying the Gilroy-Hollister groundwater basin (San Benito and Santa Clara Counties) is agricultural; 41 percent is for grazing, 11 percent is urbanized and the remaining seven percent is water and low density rural development, heavily forested land, mined land, or government land with restrictions on land use. Open space and agriculture are also the predominant land uses in the Pajaro Valley. In 1997 the total agricultural use was approximately 34,650 acres (44 percent) out of a total surface area of 79,600 acres in the Pajaro Valley.

[10] Luhdorff and Scalmanini Consulting Engineers, April 2010, 2009 Annual Report of Hydrogeologic Conditions, Water Requirements, Supplies, and Disposition, Santa Maria Valley Management Area.

Figure 2.1


Groundwater Basins and Agricultural Land Use in the Central Coast Region
Legend
Agricultural Land Use
Groundwater Basins
Gilroy
Santa Cruz
San Juan Bautista
Watsonville
Salinas
Gonzales
Soledad
King City
Paso Robles
Atascadero
San Luis Obispo
Santa Maria
Santa Barbara
Santa Ynez
N

An evaluation of cropping acres published by County Ag Commissioner offices also shows the relative amount of irrigated agricultural activity occurring within various counties that can be used to estimate regional nitrate loading. Cropping acres represent the total acres of crops produced and includes multiple cropping cycles on individual blocks of land during a given year. Subsequently, cropping acre data reported for a given county are typically larger than the amount of agricultural land use cover. For example, in Monterey County the reported cropping acres for 2009 of approximately 308,167 acres, is in excess of the estimated farmland land use cover of approximately 214,190 acres.[11] The following table shows the total estimated number of cropping acres for irrigated agriculture land use within each county. These data do not include vineyards.

Table 2.1: Cropping Acres in the Central Coast Region by County

San Luis Obispo	Monterey	Santa Barbara	Santa Clara	San Benito	Santa Cruz	Total
39,374	308,167	72,312	7,194	22,984	10,604	460,635

Table Notes:

1. Data source, 2008 and 2009 County crop Maps
2. Includes all of Santa Clara County

The above data show that agricultural activity is the most significant within Monterey County with approximately 67 percent of the total cropping acres for the Region. Santa Barbara County is a distant second at approximately 16 percent of the total amount of cropping acres within the Region.

Groundwater Extraction/Use

Water use is also an indicator of relative land use activities and the sources of impacts associated with nitrate loading, groundwater overdraft and seawater intrusion. Water-quality studies indicate that high irrigation coupled with fertilizer application offer a high potential for nitrate to move down to the water table.[12] Subsequently, intensive irrigation can result in significant leaching/recharge of applied water containing fertilizer-nitrogen or other contaminants such as salts and pesticides depending on crop type, irrigation type and efficiency, and soil conditions. For example, estimates based on agricultural water use and cropping data in the Santa Maria Valley Management Area (SMVMA), which covers most of the Santa Maria River Valley groundwater basin, indicate that deep percolation of applied irrigation water exceeding crop requirements was approximately 18,000 acre-feet in 2009 and was the largest component of return flows in the SMVMA.[13] Agricultural irrigation return flow to groundwater (percolation of unused portion of applied water) is the primary driver of agricultural related contaminant transport to groundwater.

[11] State of California Department of Conservation Farmland Mapping and Monitoring Program, 2005
[12] Kerie J. Hitt and Bernard T. Nolan, 2005, Nitrate in ground water: Using a model to simulate the probability of nitrate contamination of shallow ground water in the conterminous United States: U.S. Geological Survey Scientific Investigations Map 2881
[13] Luhdorff and Scalmanini Consulting Engineers, April 2010, 2009 Annual Report of Hydrogeologic Conditions, Water Requirements, Supplies, and Disposition, Santa Maria Valley Management Area.

Within the Salinas Valley agricultural pumping accounted for approximately 91.1percent (465,707 acre-feet) of the total estimated groundwater extraction of 511,224 acre-feet during the 2008-2009 water year (November 1st to October 31st).[14] An evaluation of the 2008 MCWRA Ground Water Summary Report data indicates vegetable crops (row crops) account for approximately 80 percent of the groundwater pumping with grapes (vineyards) a distant second at approximately 13 percent. Fertilizer application is typically the highest for vegetable crops and the climate in the Region is conducive to multiple cropping cycles per year for various crops.

Monterey is the only county in the region with a relatively accurate accounting of agricultural groundwater pumping dating back to 1995 as part of an extraction reporting program for various zones of the Salinas Valley groundwater basin. Given there is generally no regulatory oversight of groundwater pumping in California, the amount of groundwater pumping for agricultural is generally unknown or based on regional water balance estimates. For example, it is estimated that groundwater pumping for agricultural purposes in the Llagas subbasin accounts for between 33 and 55 percent (15,000 to 25,000 acre-feet) of the total annual extraction. Recent estimates for portions of the Santa Maria River Valley groundwater basin indicate that agriculture water use of 98,100 acre-feet in 2009 accounted for approximately 86 percent of groundwater pumping.[15]

Aquifer Susceptibility/Vulnerability

Depth to groundwater, soil properties and the physical characteristics of an aquifer play a significant role in aquifer susceptibility to nitrate contamination from irrigated agriculture as well as from other sources of nitrate loading. Some principal aquifers (strata used for water supply) in the Region are vulnerable to the leaching and migration of pollutants because of their geological characteristics such as overlying permeable soils and unconfined conditions (lack of clay or other confining layers above the aquifer). Aquifers considered as vulnerable include large portions of the Santa Maria, Salinas, and Gilroy-Hollister basins. However, both unconfined and confined (pressure) aquifers are susceptible to downward pollutant migration through improperly constructed, operated (e.g., fertigation or chemigation without backflow prevention), or damaged and abandoned wells. Areas characteristic of shallow groundwater and permeable soils are especially susceptible to downward pollutant migration. Areas with these physical features often coincide with aquifer recharge areas that are critical in maintaining hydrologic balance within watersheds and groundwater basins through the recharge of clean water. Land with deeper groundwater and confining layers or aquitards (i.e. clay layers) can also be susceptible to contaminant loading even though it may take decades for contaminants to migrate through the unsaturated zone before reaching the water table and water supply wells. For example,

[14] Monterey County Water Resources Agency, 2009 Ground Water Summary Report (http://www.mcwra.co.monterey.ca.us/Agency_data/GEMS_Reports/2009%20Summary%20Report.pdf)
[15] Luhdorff and Scalmanini Consulting Engineers, April 2010, 2009 Annual Report of Hydrogeologic Conditions, Water Requirements, Supplies, and Disposition, Santa Maria Valley Management Area.

studies in the Llagas subbasin indicate the shallow aquifer is highly vulnerable to nitrate impacts due to high vertical recharge rates and rapid lateral transport, but the deeper aquifers are relatively more protected by laterally extensive aquitards.[16]

Relative aquifer vulnerability to pollutants in shallow versus deep groundwater is a key factor in the potential susceptibility of water supply wells to nitrate impacts. As will be discussed in following sections of this report, there is generally an increasing trend in nitrate impacts to water supply wells going from large municipal or public water supply systems to smaller water supply systems and ultimately domestic wells for individual households. Municipal or public wells that serve as a source of drinking water supply for large communities and cities are typically screened in deeper portions of groundwater basins or within confined aquifers where nitrate concentrations tend to be lower than in overlying portions of the water bearing formation. Wells associated with small water supply systems (with two to fourteen service connections) are typically screened in shallower zones more susceptible to nitrate impacts. Domestic wells tend to be even shallower and are consequently even more susceptible to nitrate impacts. The smaller water system and domestic wells are also more likely to be subject to nitrate impacts given they are more typically located in rural areas near or within agricultural areas or subject to higher densities of septic systems. According to USGS, individuals who obtain their drinking water from shallow domestic wells near existing or former agricultural settings have the highest probability of consuming water with elevated nitrate concentrations.[17]

In addition, geochemical conditions can also govern nitrate concentrations in groundwater. For example, nitrate concentrations are typically much higher in well-oxygenated (or "oxic") groundwater or where limiting amounts of organic carbon are available within groundwater or the soil column to facilitate denitrification (biological reduction of nitrate to nitrogen gas). As opposed to areas subject to wastewater disposal or manure loading, these conditions are typical of groundwater beneath agricultural areas where recharge rates and chemical fertilizer use are high. A Lawrence Livermore National Laboratory (LLNL) study which analyzed samples from 56 wells for major anions and cations, nitrogen and oxygen isotopes of nitrate, dissolved excess nitrogen, tritium and groundwater age, and trace organic compounds, showed that synthetic fertilizer was the most likely source of nitrate in highly contaminated wells, and that denitrification was not a significant process in the fate of nitrate in the subbasin except in areas of recycled water application.[16]

[16]LLNL 2005, California GAMA Program: Sources and transport of nitrate in shallow groundwater in the Llagas Basin of Santa Clara County, California, UCRL-TR-213705

[17] Dubrovsky, N.M et al., 2010, The quality of our Nation's waters—Nutrients in the Nation's streams and groundwater, 1992–2004: U.S. Geological Survey Circular 1350, 174 p. (http://water.usgs.gov/nawqa/nutrients/pubs/circ1350)

2.2 Nitrate

Significance of Nitrate Contamination

A large body of data collected by the USGS indicates nitrate in groundwater is the most significant water quality problem in the nation and that commercial fertilizer is the primary source of loading, particularly in areas of intensive agriculture.[18] [19] [20] [21] Numerous other studies and reports also indicate nitrate is the most prevalent groundwater contaminant within California and the Central Coast Region and that it is primarily attributable to irrigated agriculture and the over application of commercial fertilizer. [22] [23] [24] [25] [26] [27] [28] [29]

The significance of the nitrate problem within California and the Region as it relates to irrigated agriculture is underscored by widespread recognition among local and state agencies and the state legislature via various programs, studies, reports, policies, guidelines and codes. For example:

- The 1987 Budget Act directed the State Water Resources Control Board (SWRCB) to prepare a report to the legislature regarding nitrate contamination of drinking water in the State of California. The resulting report[30] documented "that nitrate contamination poses a quantitative threat to the supply of drinking water (primarily groundwater resources) that is equal to or exceeds that of the toxics

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[18] Ruddy et al., 2006, County-Level Estimates of Nutrient Inputs to the Land Surface of the Conterminous United States, 1982-2001, U.S. Geological Survey National, Water-Quality Assessment Program Scientific Investigations Report 2006-5012

[19] DeSimone, L.A., 2009, Quality of water from domestic wells in principal aquifers of the United States, 1991–2004: U.S. Geological Survey Scientific Investigations Report 2008–5227, 139 p.

[20] Dubrovsky, N.M et al., 2010, The quality of our Nation's waters—Nutrients in the Nation's streams and groundwater, 1992–2004: U.S. Geological Survey Circular 1350, 174 p. (http://water.usgs.gov/nawqa/nutrients/pubs/circ1350)

[21] Kerie J. Hitt and Bernard T. Nolan, 2005, *Nitrate in ground water: Using a model to simulate the probability of nitrate contamination of shallow ground water in the conterminous United States*: U.S. Geological Survey Scientific Investigations Map 2881

[22] Santa Clara Valley Water District, 1996. Llagas Groundwater Basin Nitrate Study: Final Report

[23] LLNL 2005, California GAMA Program: Sources and transport of nitrate in shallow groundwater in the Llagas Basin of Santa Clara County, California, UCRL-TR-213705

[24] Department of Water Resources, California's Water, Bulletin 118, Update 2003

[25] Association of Monterey Bay Area Governments (AMBAG), October 1978. "Investigation of Nonpoint Source of Groundwater Pollutants in Santa Cruz and Monterey Counties, California." H. Esmaili and Associates

[26] Santa Clara Valley Water District, March 2010, 2009 Groundwater Quality Report.

[27] LLNL Nitrate Working Group, 2002, Nitrate Contamination in California Groundwater: An Integrated Approach to Basin Assessment and Resources Protection, Nitrate White Paper, v8.doc, December 10, 2002, UCRL-ID-151454 DRAFT

[28] State Water Resources Control Board, *Nitrate in Drinking Water Report to the Legislature,* October 1988, Report No. 88-11WQ Div. of Water Quality (Anton et al., 1988)

[29] CCRWQCB, 1995, Assessment of Nitrate Contamination in Ground Water Basins of the Central Coast Region – Preliminary Working Draft (Nitrate Assessment)

[30] State Water Resources Control Board, *Nitrate in Drinking Water Report to the Legislature,* October 1988, Report No. 88-11WQ Div. of Water Quality (Anton et al., 1988)

issues which have received so much public attention." The report identified agricultural activities, particularly those involving the use of nitrogen fertilizers, as the largest source of nitrate in California groundwater.

- In 1988, the Monterey County Board of Supervisors formed the Ad Hoc Salinas Valley Nitrate Advisory Committee. The purpose of the committee was to provide recommendations to the Supervisors regarding actions and programs necessary to protect the drinking water supplies of the Salinas Valley.[31]
- In 1988 the Nitrate Working Group (NWG) was appointed by the Secretary of the California Department of Food and Agriculture (CDFA) to study the nitrate problem relating to agriculture in California. Recommendations within the resulting NWG 1989 report, "Nitrate and Agriculture in California," were the basis for the following three points.
    - In January of 1990, the Nitrate Management Program (NMP) was established by the Director of CDFA. Its objectives were to identify and prioritize nitrate sensitive areas throughout California, organize voluntary nitrate management programs, develop nitrate-reducing farming practices, and to organize and support research and demonstration projects.
    - The CDFA NMP developed Criteria for Nitrate-Sensitive Areas and identified the Salinas Valley, Santa Maria Valley and Santa Inez Valley as three of the five highest priority nitrate-sensitive areas in the state.[32]
    - CDFA established the Fertilizer Research and Education Program (FREP) in 1990 when California Food and Agricultural Code Section 14611(b) authorized a mill assessment on the sale of fertilizing materials "to provide funding for research and education regarding the use and handling of commercial and organic fertilizers, including, but not limited to, any environmental effects."
- The Santa Clara Valley Water District (SCVWD) created a Nitrate Management Program in October 1991 to investigate and remediate increasing nitrate concentrations in the Llagas subbasin. The results of a study completed in February 1996, suggested that nitrate concentrations are increasing over time and that elevated concentrations of nitrate still exist in the Llagas subbasin. The study identified fertilizer as the primary source of nitrogen loading.[33]
- The Central Coast RWQCB published the "Assessment of Nitrate Contamination in Ground Water Basins of the Central Coast Region – Preliminary Working Draft", December, 1995 (Nitrate Assessment). The study concluded that fifteen groundwater basins within the Region have significant nitrate contamination.
- In 1997, the SCVWD began implementation of a Nitrate Management Program. Based on a study of nitrate contamination in shallow groundwater that included an assessment of potential sources of nitrate, the management plan is primarily focused on measures to reduce loading from agricultural fertilizer application.

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[31] Monterey County Flood Control and Water Conservation District, November 1990. "Report of the Ad Hoc Salinas Valley Nitrate Advisory Committee." Zidar, Snow, and Mills.
[32] California Department of Food and Agriculture website; http://www.cdfa.ca.gov/is/fflders/about_fertilizer.html
[33] Santa Clara Valley Water District, July 2001. SCVWD Groundwater Management Plan

- In 1997 the MCWRA convened an ag focused Nitrate Technical Advisory Committee (NTAC) to identify elements for a Five Year Nitrate Management Program (NMP). MCWRA has implemented ten of the thirteen recommended elements of the resulting 1998 [draft] NMP consisting primarily of water quality monitoring, source reduction outreach, education and research, and elements of a groundwater protection program.
- A Senate Bill was passed in September 2008 amending sections of the California Public Resources Code to restructure how some of Proposition 84 money would be spent. The bill set aside $180 million for small community drinking water system infrastructure improvements and related actions to meet safe drinking water standards with an emphasis on nitrate impacts. The bill also set aside two million dollars to conduct nitrate studies in the Tulare and Salinas Valley Groundwater Basins.
- On February 3, 2009 the State Water Resources Control Board adopted the Recycled Water Policy (via Resolution No. 2009-0011) which calls in part for the development and implementation of basin-wide or watershed wide Salt and Nutrient Management Plans for each groundwater basin/sub-basin in the state.

Nitrogen/Nitrate Terminology and Convention

Nitrate concentrations in water are reported in different units of measurement in the regulatory literature: expressed as milligrams of nitrate (NO_3) per liter of water (mg/L nitrate-NO_3), or as milligrams of nitrogen (N) per liter of water (mg/L nitrate-N). The Federal drinking water standard is based on units of nitrate expressed as N (10 mg/L nitrate-N). California is the only state with a primary Maximum Contaminant Level (MCL) drinking water standard for nitrate expressed as nitrate (45 mg/L nitrate-NO_3). Consequently, water supply quality data for nitrate in California are primarily reported as nitrate- NO_3 for comparison with the MCL of 45 mg/L nitrate-NO_3. However, use of the nitrate-N convention makes analysis and comparison to the other various forms of nitrogen in natural systems much more straight forward. The Federal and State standards are roughly equivalent based on a conversion factor of 4.425 (i.e. 4.425 pounds of nitrate contains one pound of nitrogen; the same conversion works for any measure of mass or concentration such as milligrams per liter). For this discussion we will primarily use the nitrate-N convention with the exception of the "Nitrate Impacts to Beneficial Uses" discussion, which will use the nitrate-NO_3 convention, given most groundwater quality data are reported as mg/L nitrate-NO_3 since it relates directly to the California MCL (primary drinking water standard) of 45 mg/L nitrate-NO_3.

Sources of Nitrogen/Nitrate

Sources of nitrate loading to groundwater include:

1) fertilizer application
2) grazing/feedlots/dairies
3) point source discharges (spills) from fertilizer handling facilities
4) municipal and industrial wastewater discharges

5) onsite domestic wastewater (septic) system discharges
6) nitrogen fixation (conversion of nitrogen gas by bacteria present on the root nodules of legumes like soybeans, alfalfa, peanuts, etc.)
7) atmospheric deposition from airborne emissions (fossil fuel emissions from utilities, factories and automobiles, and emissions from agricultural operations)

Nitrate contamination of groundwater depends on a number of factors regarding nitrogen input (available sources of excess nitrogen outside of the natural nitrogen cycle) and aquifer susceptibility to contaminant transport. However, nitrogen input is typically governed by the predominant land use activities within a given area. Although increased nitrogen input or loading within a given watershed doesn't always result in increasing nitrate concentrations in groundwater, nitrogen loading is generally the governing factor in the build-up of nitrate in groundwater. In natural systems consistent with undeveloped watersheds the nitrogen cycle tends to be in balance between animal, bacterial and plant sources of organic nitrogen (proteins and waste products), atmospheric nitrogen (nitrogen gas) and inorganic sources of nitrogen bound in the soil/rock such that surface water and groundwater generally do not contain significant amounts of nitrate. Nitrate occurs naturally in groundwater at levels generally less than 2 mg/L nitrate-N (8.9 mg/L nitrate-NO_3), and nitrite is generally negligible.[34]

In unnatural systems consistent with developed watershed conditions such as occur in areas of high population density and intensive agricultural activity, including irrigated agriculture and animal husbandry, nitrogen inputs from inorganic [chemical or synthetic] fertilizers and human and animal wastes can disrupt the nitrogen cycle and result in significant amounts of nitrogen (as nitrate) building up in surface water and groundwater. Consequently, the primary sources of nitrogen resulting in nitrate loading/impacts to groundwater are fertilizer (both organic and inorganic), animal manure, human waste and to a much lesser extent depending on regional conditions, atmospheric deposition from airborne emissions and nitrogen fixation by legumes. As compared to areas of the Midwest and Northeast, atmospheric deposition of nitrogen is much less prevalent on the West Coast. Large-scale commercial production of legumes like soybeans or alfalfa is also not as prevalent in the Region as compared to the Midwest or other portions of the State.

Historical Fertilizer-Nitrogen Use

The California Department of Food and Agriculture (CDFA) has been tracking fertilizer sales in California since 1923 and by county since 1971. Figure 2.2 shows the amount of nitrogen, phosphorus and potassium in tons (2,000 pounds per ton) contained within fertilizing materials sold in California on an annual basis from 1923 to 2008. These data indicate the amount of nitrogen contained within fertilizer sold in California has increased over 800 percent since the early 1940's and that on average over the last ten years approximately 800,000 tons per year of nitrogen contained within fertilizer has

[34] Mueller D. K. and Helsel D. R., 1996, Nutrients in the Nation's Waters - Too Much of a Good Thing, Circular 1136, U.S. Geological Survey.

been applied to land in California. An evaluation of the CDFA fertilizing materials data by county indicates the counties in the Central Coast Region accounted for between 4 percent and 12 percent (26,400 to 86,000 tons of nitrogen) of the total amount of fertilizer-nitrogen sold in California annually between 1971 and 2008.

Figure 2.2: Amount of Nitrogen, Phosphorus and Potassium Contained within Fertilizing Materials Sold Annually in California from 1923 to 2008

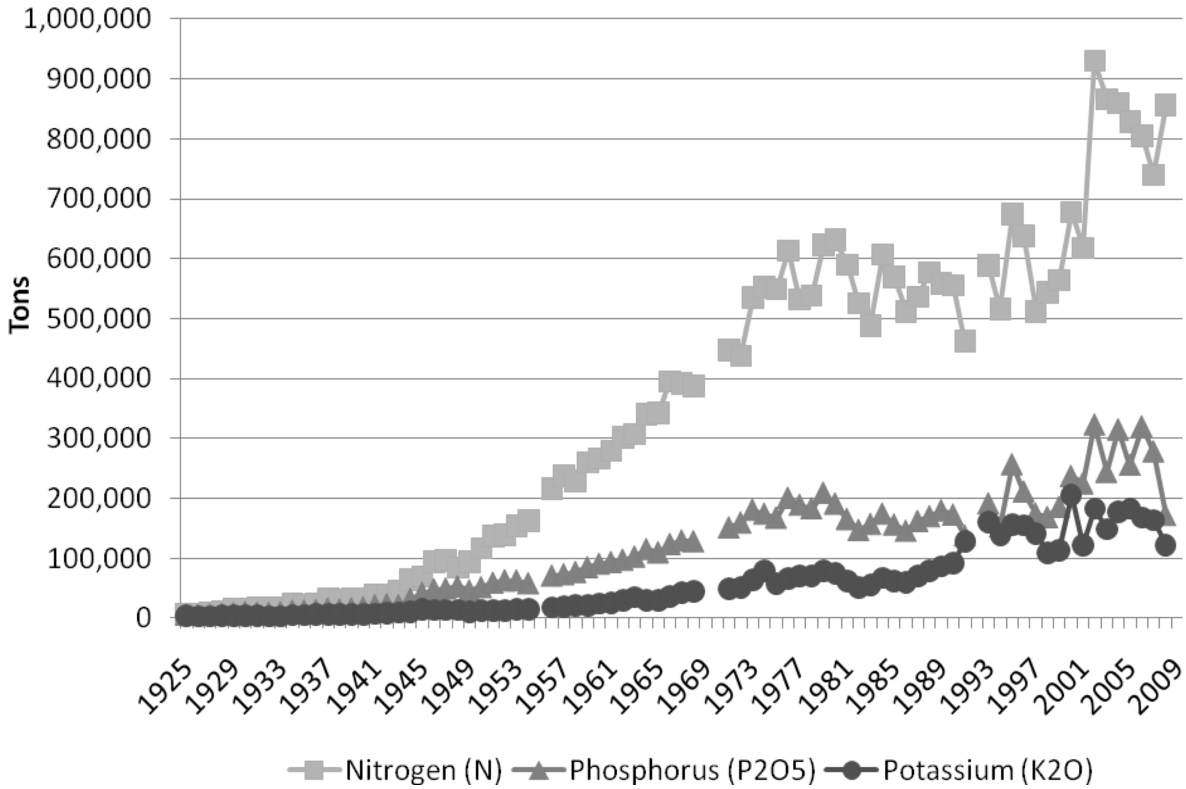
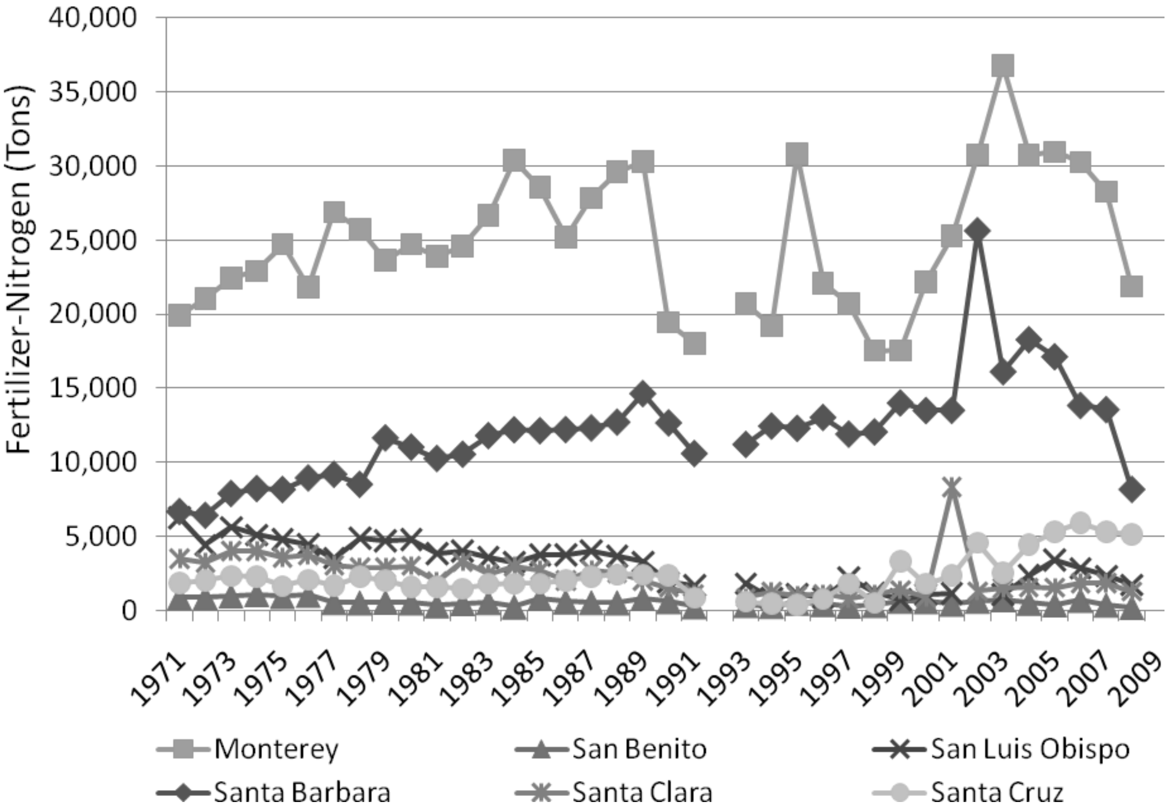


Figure Note:

CDFA data represent tonnage of raw materials contained within commercial fertilizers sold/distributed by licensed distributers (last point of sale) within California. Data do not account for potential reporting errors. According to CDFA, about 90 percent of reported fertilizer distribution is for agricultural farm use and 10 percent is for home and garden use.

Of the six main counties in the Region (not including San Mateo and Ventura County) Monterey and Santa Barbara Counties accounted for 43 percent to 66 percent and 24 percent to 30 percent of the total amount of nitrogen contained within fertilizers sold, respectively, within the region between 1971 and 2008. Figure 2.3 shows the amount of nitrogen in tons contained within fertilizing materials sold in the six main counties within the region between 1971 and 2008 (data not yet available for 2009). These data generally mimic the relative amount of cropping acres or agricultural land use acreage data by county. It is likely that a portion of the fertilizer nitrogen applied in San Benito, Santa Cruz and Santa Clara Counties is purchased in Monterey County due to the large number of commercial fertilizer distributers in Monterey County.

Figure 2.3: Amount of Nitrogen Contained within Fertilizing Materials Sold Annually in the Central Coast Region by County from 1971 to 2008



These data indicate steady decreasing trends in fertilizer usage within San Luis Obispo, Santa Clara and San Benito Counties with overall increases in fertilizer usage in Monterey, Santa Barbara and Santa Cruz Counties between 1971 and 2008. The figure also indicates significant fluctuations in fertilizer usage in Monterey County since 1988 and similar decreasing trends in Monterey and Santa Barbara Counties since 2002. The reasons for the observed fluctuations in Monterey County and recent drop in fertilizer sales for these two counties is currently uncertain, but it could be a result of several factors including changes in fertilizer efficiency, regional shifts in crop types that require less/more fertilizer, changes in land use, increased fertilizer costs, increased importing of fertilizers from other counties and changes in reporting or reporting errors. Voluntary fertilizer efficiency programs or moderate fertilizer cost fluctuations would not be expected to create such dramatic shifts in fertilizer use; whereas, the market could reasonably dictate dramatic shifts in fertilizer use over short time periods by dictating what crops are produced.

Compared to gross agricultural revenue, fertilizer is generally inexpensive, and anecdotal evidence indicates that over application of fertilizer is a cheap form of insurance to ensure high crop yield and market value. For example, the estimated annual cost of fertilizer-nitrogen of $23.6 million in Monterey County based on CDFA

Fertilizing Materials Tonnage data and a nitrogen fertilizer value of $0.60 per pound[35] is only 0.62 percent of the $3.8 billion gross production value of agricultural crops for Monterey County in 2008. In addition, for high value crops like romaine and iceberg lettuce, fertilizer costs generally account for less than five percent of the annual production budget.[36] [37] However, significant increases in fertilizer costs should not be ruled out given fertilizer and agricultural chemical costs are generally the second largest expense for individual growers at up to 18 percent of total expenses (second to labor costs at about 30 percent).[38] Annual average prices paid for fertilizers increased 264 percent between 2002 and 2008 resulting in fertilizer-nitrogen costs increasing from approximately $0.20 per pound to about $0.55 per pound.[39] [40] The dramatic increasing trend in fertilizer-nitrogen cost mirrors the decrease in fertilizer-nitrogen usage shown in the above figure for Monterey and Santa Barbara Counties from 2002 to 2008. Fertilizer-nitrogen costs are closely tied to natural gas prices given one of the most common fertilizers and fertilizer feedstocks, anhydrous ammonia, is produced with natural gas.

Regional shifts away from crops like celery and broccoli to crops like strawberries and lettuce, which require less nitrogen, could result in significant reductions in regional fertilizer use. Conversion of land from row crops to grapes (vineyards) would also be expected to result in significant reductions in fertilizer use, but vineyards typically do not supplant prime agricultural land. Additional evaluations of historical cropping data by county would be required to determine if a correlation exists between regional fertilizer-nitrogen use and changes in cropping patterns.

The steady decreasing trend of fertilizer use in Santa Clara County is likely attributable to the gradual changes in land use away from irrigated agriculture and to rural and urban development that has occurred over the past 30 years. The decreasing trend for San Luis Obispo County is also likely a result of changes in land use away from irrigated agriculture. Without an appropriate level of fertilizer application reporting and tracking on an individual grower or crop basis, determining local and regional reductions in fertilizer use and increased efficiency is virtually impossible.

Nitrogen Input Analysis

[35] Michael Cahn, 2010, University of California Cooperative Extension, Monterey County, Optimizing Irrigation and Nitrogen Management in Lettuce for Improving Farm Water Quality, Northern Monterey County, Grant No. 20080408 project report

[36] Smith R.F., K.M. Klonsky and R.L. DeMoura. 2009a. Sample costs to produce romaine hearts leaf lettuce. University of California Special Publication, LT-CC-09-1.

[37] Smith R.F., K.M. Klonsky and R.L. DeMoura. 2009b. Sample costs to produce iceberg lettuce. University of California Special Publication, LT-CC-09-2.

[38] Mir Ali & Gary Lucier, Production Expenses of Specialized Vegetable and Melon Farms, U.S. Department of Agriculture, A Report from the Economic Research Service, VSG-328-01, September 2008.

[39] T. Bruulsema & T. Murrell, Corn Fertilizer Decisions in a High-Priced Market, Better Crops with Plant Food (A Publication of the International Plant Nutrition Institute), 2008, Number 3, Volume 92.

[40] U.S. Department of Agriculture, Economic Research Service, Farm Income and Costs: 2010 Farm Sector Income Forecast (http://www.ers.usda.gov/Briefing/FarmIncome/nationalestimates.htm)

Next to fertilizer, the second and third largest contributing sources of nitrogen input in developed areas like that of the Central Coast Region are from human and animal waste (primarily livestock waste). Population within a given area provides a direct and accurate way of estimating the gross amount of available nitrogen produced via human waste (feces and urine) given one person (average adult) produces about 12.5 pounds of nitrogen per year.[41] Similarly, livestock numbers can be used to accurately estimate the gross amount of nitrogen produced within a given area via animal waste. Dairy cows and cattle produce about 120.5 pounds of nitrogen per year per 1,000 pound of animal.[42]

The following figure compares the relative gross amount of available nitrogen for the three largest sources of nitrogen input, fertilizer, human waste and livestock waste, for the entire Central Coast Region (pie chart) and by county (histogram) in tons of nitrogen per year.

[41] H. Heinonen-Tanki & C. van Wijk-Sijbesma, 2004, Human Excreta for Plant Production, Elsevier, Bioresource Technology; Article in Press (accepted October 22, 2003)
[42] Soil Conservation Service, 1992, Agricultural Waste Management Field Handbook, Chapter 4, U.S. Government Printing Office, Washington, D.C.

Figure 2.4: Relative gross available nitrogen input from the three largest sources (fertilizer, human waste and livestock waste) for the Central Coast Region and by County

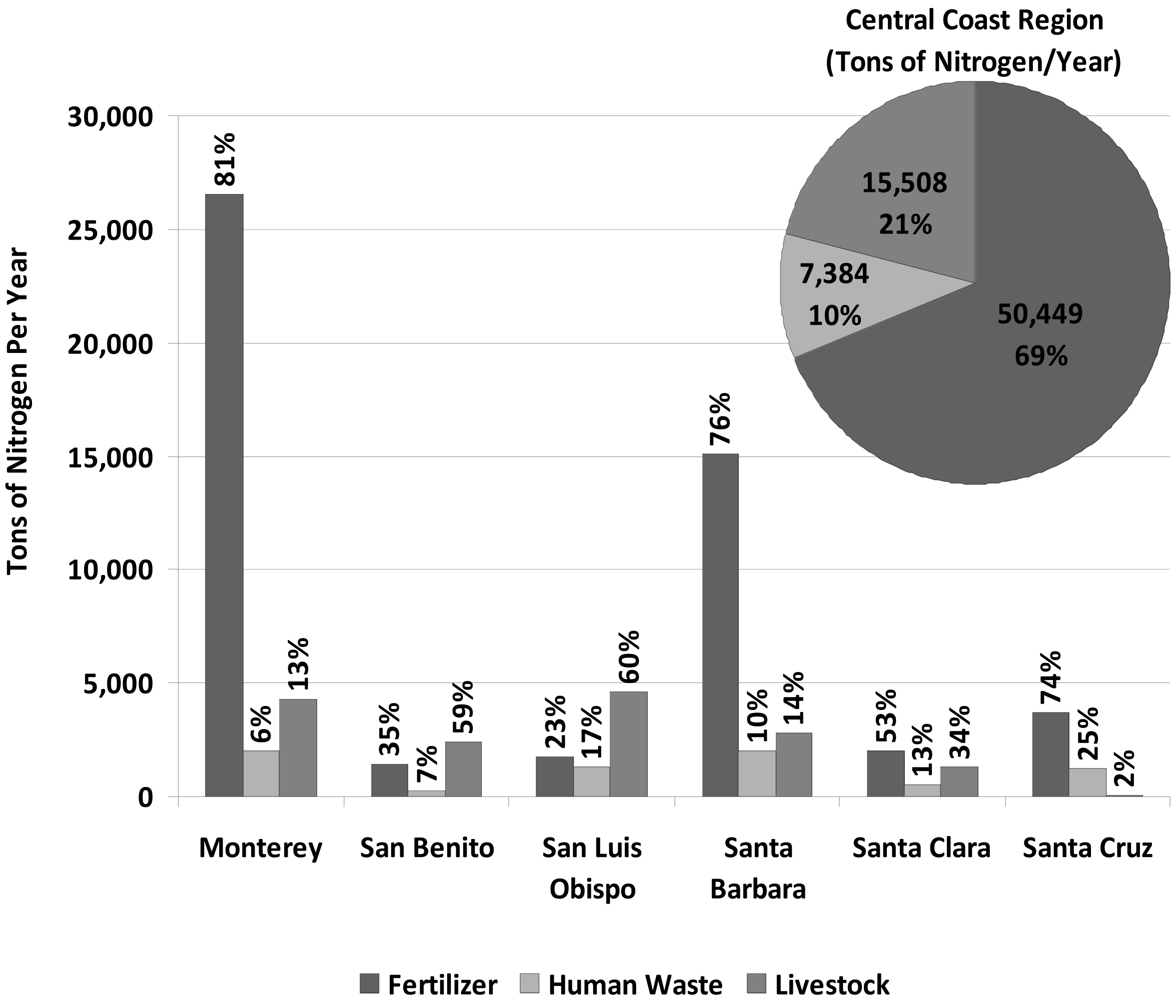


Figure Notes:

1. The gross amount of available nitrogen from fertilizer is based on the average of CDFA annual Fertilizing Materials Tonnage Data from 1998 to 2008.
2. Human waste calculation based on California State Association of Counties 2009 population statistics and U.S. Census Bureau 2009 population estimates
3. Livestock only includes dairy cows and cattle based on CDFA published California Agricultural Production Statistics[43] for dairy cows and cattle by region and county.

These data clearly indicate that of the three largest sources of nitrogen input, fertilizer is by far the largest source of potential nitrogen/nitrate loading within the Region at 69 percent and up to 75, 76 and 81 percent by county for Santa Cruz, Santa Barbara and Monterey Counties, respectively. On an annual basis in Monterey County alone, approximately 23,900 tons of nitrogen are contained within fertilizer applied for

[43] http://www.cdfa.ca.gov/Statistics/

commercial agricultural purposes (90 percent of 26,555 tons of nitrogen). Another more detailed estimate using 2008 cropping acre data[44] and University of California Cooperative Extension (UCCE) sample cost and return studies[45] for the various crops grown in Monterey County resulted in a slightly higher estimate of applied fertilizer nitrogen of approximately 28,372 tons-nitrogen. These two estimates are in relative agreement with each other.

In the absence of readily available data for other agricultural livestock such as horses, poultry, swine, sheep, goats, etc. and domesticated animals such as household pets, it is assumed that the relative contribution from livestock would be higher within the region and selected counties. However, the relative increase would not significantly change this analysis because, with the exception of horses, these animals produce significantly less manure-nitrogen per day as compared to cattle.[46]

Atmospheric deposition of nitrogen is generally negligible in areas of significant agricultural production relative to fertilizer-nitrogen inputs. County level estimates by USGS indicate that atmospheric deposition of nitrogen (0.09 to 0.18 pounds per acre per year) within the agricultural areas of the Region equate to less than 1.3 to 2.5 percent of the total fertilizer-nitrogen input.[47] Comparison of the USGS data with CDFA fertilizer-nitrogen data for the Region (7.22 million acres) indicate even lower relative potential nitrogen loading contributions from atmospheric deposition of 0.65 to 1.3 percent of the estimated fertilizer-nitrogen input of approximately 50,449 tons. Coincidently, livestock production and the use synthetic fertilizer are responsible for about half of the global emission of ammonia (NH_3)[48] and according to the USEPA, agricultural soil management practices accounted for 64 percent of the nitrous oxide (N_2O) emissions in the US between 1990 and 2008, of which fertilizer use was a primary source.[49]

The USGS implemented a similar methodology to estimate nitrogen inputs regionally on a national basis from the three primary nonpoint sources of nitrogen, fertilizer use, livestock manure, and atmospheric deposition.[50] The USGS study also indicated that fertilizer was the primary source of loading among these three sources within the region.

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[44] 2008 Crop Report for Monterey County, Agricultural Commissioner's Office
[45] http://coststudies.ucdavis.edu/
[46] Soil Conservation Service, 1992, Agricultural Waste Management Field Handbook, Chapter 4, U.S. Government Printing Office, Washington, D.C.
[47] Ruddy et al., U.S. Geological Survey, National Water-Quality Assessment Program, County-Level Estimates of Nutrient Inputs to the Land Surface of the Conterminous United States, 1982-2001, Scientific Investigations Report 2006-5012
[48] A.F. Bouwman and K. W. Ven Der Hoek, 1997, Scenarios of Animal Waste Production and Fertilizer Use and Associated Ammonia Emission from Developing Countries, Atmospheric Environment, Vol. 31, Issue 24, December 1997, Pages 4095-4102.
[49] Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2008, U.S. EPA # 430-R-10-006 (April 2010), http://epa.gov/climatechange/emissions/usinventoryreport.html
[50] Ruddy et al., USGS, National Water-Quality Assessment Program, County-Level Estimates of Nutrient Inputs to the Land Surface of the Conterminous United States, 1982-2001, Scientific Investigations Report 2006-5012

These relative gross available nitrogen estimates coupled with the significant amount of agricultural land use activity and groundwater pumping (resulting in high agricultural return flows to groundwater) clearly point to irrigated agriculture as the largest potential source of nitrate loading to groundwater in the Region with an emphasis on specific areas subject to intensive agriculture land use.

Nitrogen/Nitrate Loading to Groundwater

Potential mechanisms for nitrate loading to groundwater from agriculture practices include:

1) Leaching of applied fertilizer-nitrogen
2) Leaching of tailwater discharges containing fertilizer-nitrogen from farming operations and greenhouse
3) Liquid fertilizer hookups (fertigation) on well pump discharge lines lacking adequate back flow prevention devices
4) Wells with screened intervals spanning multiple aquifers
5) Wells without adequate or with failing sanitary seals
6) Spills and/or uncontrolled wash water or runoff from fertilizer handling and storage operations
7) Infiltration and leaching from tailwater holding ponds

Of these potential mechanisms, leaching of applied fertilizer-nitrogen poses the most significant and widespread source of nitrogen loading to groundwater. The widespread application of water soluble chemical fertilizers within areas of intensive agricultural land use covering thousands of acres coupled with irrigation and fertilization inefficiencies can result in significant leaching of nitrate below the root zone of targeted crops that can build up over time in groundwater and impact major portions of entire aquifers.

Estimates by a widely recognized leader in agricultural research from the UC Davis Cooperative Extension, Dr. Thomas Harter, indicate that more than 37.5 percent of applied fertilizer-nitrogen (more than 80 pounds of nitrogen per acre per year) is leached to groundwater in the form of nitrate.[51] Based on the amount of nitrogen contained within fertilizers sold in Central Coast counties over the last ten years, this would equate to over 17,000 tons of nitrogen (75,225 tons of nitrate) being discharged to groundwater on average every year for the last ten years from irrigated agriculture. This would equate to an average groundwater loading of approximately 74 pounds of nitrogen (327.5 pounds of nitrate) per cropping acre of irrigated agriculture per year. For perspective, this would be equivalent to dumping about 2,000 dump truck loads of pure ammonium-nitrate fertilizer directly into our drinking water supplies every year. The total annual cost of the fertilizer-nitrogen lost to leaching would be about $20.4 million based on an assumed nitrogen fertilizer value of $0.60 per pound.

[51] Thomas Harter, 2003. Agricultural Impacts on Groundwater Nitrate, Southwest Hydrology, Vol 8/No.4, July/August.

Preliminary studies by the International Plant Nutrition Institute (IPNI) indicate increasing trends in nitrogen balances (i.e. nitrogen application in excess of crop requirements) and decreasing trends in nitrogen removal to use ratios (i.e. ratio of nitrogen taken up by crop to nitrogen applied) for agricultural areas within the Region between 1987 and 2007.[52] Of the eighteen hydrologic regions in the U.S., the California hydrologic region had the highest positive nitrogen balances for the two most recent study years in 2002 and 2007 and generally the lowest nitrogen removal to use ratios. Evaluation of the IPNI data for the Region indicate that in 2007, 70 percent or more fertilizer-nitrogen was applied than needed by crops and that 151 to 300 pounds of nitrogen were applied per planted acre in excess of what was removed by the crops (saleable product). The excess applied nitrogen is partitioned into three main components, organic nitrogen retained in the portion of the crops (roots, stems, leaves, etc.) not harvested and subsequently tilled back into the soil, atmospheric loading via direct ammonia volatilization and biologically mediated nitrous oxide (N_2O) production, and leaching below the root zone. Subsequently, the IPNI study notes that highly positive nitrogen balances, like those estimated for the Central Coast Region, may pose some increased risk for losses of nitrogen to the environment. Furthermore, the IPNI study concludes that where trends for high partial balances of nitrogen are observed, and/or low removal to use ratios are noted, it may be important to monitor quality of surface water and groundwater to identify opportunities for special management considerations to help remedy any unacceptable risks of potential water quality impairment.

The relative amount of nitrate loading to groundwater varies depending on different crop types, grower practices (primarily fertilizer application and irrigation practices) and soil conditions. From a crop perspective, certain crops require more nitrogen and therefore present a higher potential for leaching. For example, UCCE sample cost and return studies for the five major crops grown in the Region indicate lettuce, strawberries, broccoli, cauliflower and celery require nitrogen application rates of approximately 150, 180, 200, 240 and 275 pounds of nitrogen per acre, respectively. This would equate to a range of potential groundwater loading of 56.3 to 103 pounds of nitrogen per acre depending on what crop is grown (based on the 37.5 percent leaching fraction). A recent study conducted by UCCE demonstrating optimal irrigation and nitrogen management practices for lettuce crops grown in the Salinas Valley documented a wide range of standard fertilizer-nitrogen application rates of 77 to 248 pounds of nitrogen per acre as well as ranges of applied water of 9.9 inches to 19.4 inches by various growers.[53] Nitrogen leaching/loading beneath the five trial plots during individual grower standard practices trials was estimated at 37.3 to 49.5 pounds of nitrogen per acre based on soil pore water nitrogen concentrations of 104.9 to 178 mg/L nitrate-N beneath the plots. These leachate concentrations are approximately 10 to 18 times the

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[52] IPNI, 2010. A Preliminary Nutrient Use Geographic Information System (NuGIS) for the U.S., Item No. 30-3270, Reference No. 09130

[53] Michael Cahn, 2010, University of California Cooperative Extension, Monterey County, Optimizing Irrigation and Nitrogen Management in Lettuce for Improving Farm Water Quality, Northern Monterey County, Grant No. 20080408 project report

drinking water standard (using the federal standard convention of 10 mg/L nitrate-N for comparison). Test trials on the same plots implementing fertilizer and irrigation best management practices resulted in decreased nitrogen leaching/loading values of 11.2 to 31.4 pounds of nitrogen per acre while achieving equivalent yields. Although the range of nitrogen loading was significantly reduced (by 30 to 63 percent), the measured leachate nitrate concentrations of 116.4 to 174 mg/L nitrate-N were still significantly in excess (12 to 17 times) of the drinking water standard. This study shows that a combination of increased irrigation and fertilizer efficiency can significantly reduce nitrate mass loading to groundwater, but that achieving leachate concentrations approaching the drinking water standard will likely require more significant changes in agricultural practices.

Approximately 53 percent of the estimated nitrogen loading to groundwater within the Region is attributable to irrigated agriculture in Monterey County at levels upwards of 9,000 tons of nitrogen (39,825 tons of nitrate). Based on the lettuce grower standard practice groundwater loading range of 37.3 to 49.5 pounds of nitrogen measured by UCCE and the total amount of cropping acres for lettuce in Monterey County during 2009[54], 2,670 to 3,544 tons of nitrogen were likely leached to groundwater from lettuce operations alone in Monterey County in 2009. The subsequent cost of the fertilizer-nitrogen lost to leaching would be $3.2 to $4.3 million based on an assumed nitrogen fertilizer value of $0.60 per pound. Based on 2008 and 2009 cropping acre data, lettuce accounts for approximately 45 percent of the cropping acres in Monterey County and 38 percent in the Region.

Estimates for the Salinas Valley groundwater basin conclude that of the various sources of nitrogen loading to groundwater, including cropland (irrigated agriculture), animal feeding operations, sewage treatment facilities, dairies, septic systems and atmospheric deposition, the highest loading comes from the application and associated discharge/leaching of agricultural fertilizers from cropland. The following table presents a comparison of 1978 and current estimates of nitrogen loading (in tons per year) to groundwater in the Salinas Valley.

Table 2.3: Estimated Nitrogen Loading to Groundwater in the Salinas Valley

Source	**1978 AMBAG Study[1]**		**Current Estimate**	
	Tons/year	**% Contribution**	**Tons/year**	**% Contribution**
Cropland	8,500[2]	78.4	10,640[5]	83.6
Feedlots	1,687	15.6	1,071[6]	8.4
Wastewater	496[3]	4.5	687[7]	5.4
Dairies	78	0.7	27	0.2
Septic Systems	61	0.6	286[8]	2.2
Others	16[4]	0.1	10[9]	0.1

Table Notes:

[54] Monterey County Crop Report, 2009; http://www.co.monterey.ca.us/ag/pdfs/CropReport2009.pdf

1. Association of Monterey Bay Area Governments (AMBAG), October 1978. “Investigation of Nonpoint Source of Groundwater Pollutants in Santa Cruz and Monterey Counties, California.” H. Esmaili and Associates (data excerpted from Table 5-12b)
2. After subtracting nitrogen in groundwater pumped for irrigation
3. Includes combined nitrogen loading from municipal and industrial wastewater treatment facilities.
4. Unspecified industrial sources
5. Based 2008 Ag Commissioner cropping acres data and UCCE sample cost and return studies assuming 37.5 percent leaching fraction
6. CDFA California Cattle Inventory by Class and County, January 1, 2008-09; assumes 25 percent nitrogen leaching fraction
7. Scaling of 1978 AMBAG estimate based on approximately 40 percent population increase between 1978 and 2009 in Monterey County
8. Assumes 12,500 septic systems in Monterey County, 375 gallons per day discharge of 40 mg/L total nitrogen
9. Average regional atmospheric deposition of 0.13 pounds per acre day (USGS) and 37.5 percent leaching fraction

The loading estimates presented in the table above clearly demonstrate that fertilizer application is the primary source of nitrogen loading to groundwater in the Salinas Valley that is contributing to nitrate impacts. This would even be the case if higher leaching fractions were assumed for the other sources given the fertilizer-nitrogen input is orders of magnitude larger than the other sources. Comparison of the 1978 and current estimates for the cropland category indicate that fertilizer application and subsequent loading have likely increase by approximately 25 percent since 1978. It should be noted that there is double counting inherent in the wastewater and septic system estimates given an unknown percentage of the population increase within the county is served by septic systems and not municipal wastewater treatment facilities.

Nitrate loading studies conducted in the Llagas subbasin (part of the Gilroy-Hollister groundwater basin) also conclude that out of various sources that are responsible for nitrogen loading to groundwater, including septic tanks, sewage treatment facilities, agricultural fertilizers, animal feeding operations, and greenhouse operations, the highest loading comes from the application and associated discharge/leaching of agricultural fertilizers.[55] A 2005 LLNL study applying multiple analytical and isotopic techniques concluded that, “inorganic fertilizer is almost certainly the main source of nitrate to shallow groundwater in the Llagas subbasin.”[56]

The scale and severity of the documented nitrate impacts to groundwater basins and drinking water supplies within or proximal to agricultural areas are consistent with this magnitude of loading.

Nitrate Impacts to Groundwater Beneficial Uses

The USGS National Ambient Water Quality Assessment (NAWQA) program has demonstrated that a large fraction of the nation’s groundwater supply is impacted by

[55] Santa Clara Valley Water District, 1996. Llagas Groundwater Basin Nitrate Study: Final Report
[56] LLNL 2005, California GAMA Program: Sources and transport of nitrate in shallow groundwater in the Llagas Basin of Santa Clara County, California, UCRL-TR-213705

anthropogenic (resulting from human activities) nitrate contamination, where impact is defined as the presence of nitrate above a threshold value of 3-4 mg/L nitrate-N (14-17 mg/L nitrate-NO_3). [57] [58] [59] [60] However, it should be noted that groundwater within various geographic areas or deeper aquifers of the Central Coast Region do not contain detectible levels of nitrate. Nitrate occurs naturally in groundwater at levels generally less than 2 mg/L nitrate-N (Mueller and Helsel, 1996), and nitrite is generally negligible.[61]

Available data show that nitrate impacts to the drinking water beneficial uses of groundwater in the Region are the most widespread and severe in areas subject to the most intensive irrigated agriculture land use activities such as the Salinas, Pajaro, Santa Maria, and Gilroy-Hollister groundwater basins. Nitrate concentrations exceeding safe drinking water standards within major portions of these groundwater basins pose a significant threat to drinking water beneficial uses and public health. Drinking water system susceptibility to nitrate impacts generally increases with proximity to agricultural areas and decreasing well depth. For example, public supply wells are typically very deep and generally less susceptible to nitrate impacts than shallower small water system or individual (domestic) wells. Consequently, higher incidences and levels of drinking water system nitrate impacts are being observed around areas with intensive agricultural land use patterns and/or for smaller water supply systems reliant on shallower groundwater wells.

Public Water Supply Systems

Currently, more than 700 public supply wells in the Central Coast Region provide drinking water to the public by cities, counties, and local water agencies. California Department of Public Health (CDPH) water quality data for public supply wells (for water supply systems with 15 or greater service connections) in the Central Coast Region show that the municipal beneficial use of groundwater are impaired or threatened by nitrates. During the period between 1979 and 2009, 13 percent of all the public water supply wells within the Region contained nitrate in excess of the drinking water standard and 31 percent were under the influence of human sources of nitrate (contained nitrate between 14 mg/L nitrate-NO_3 and the drinking water standard of 45 mg/L nitrate-NO_3). The average nitrate concentration for these data is about half of the drinking water standard with maximum nitrate concentrations of over 10 times the drinking water

[57] Nolan B. T., Hitt K. J., and Ruddy B. C. (2002) Probability of nitrate contamination of recently recharged groundwaters in the conterminous United States. *Environmental Science & Technology* **36**(10), 2138-2145.

[58] Nolan B. T., Ruddy B. C., Hitt K. J., and Helsel D. R. (1997) Risk of nitrate in groundwaters of the United States - A national perspective. *Environmental Science & Technology* **31**(8), 2229-2236.

[59] Squillace P. J., Scott J. C., Moran M. J., Nolan B. T., and Kolpin D. W. (2002) VOCs, pesticides, nitrate, and their mixtures in groundwater used for drinking water in the United States. *Environmental Science & Technology* **36**(9), 1923-1930.

[60] W.M. Alley, 1993. Regional Ground-Water Quality. Van Nostrand Reinhold, New York NY

[61] Mueller D. K. and Helsel D. R., 1996, Nutrients in the Nation's Waters - Too Much of a Good Thing, Circular 1136, U.S. Geological Survey.

standard. Mapping of the public water supply well data shows that most of the impacted wells are located in areas proximal to intensive agricultural land use activity.

Focusing on the Salinas Valley groundwater basin (excluding the Paso Robles subbasin) the number of public supply wells containing nitrate in excess of the drinking water standard increases to 18 percent and the number of wells under the influence of human sources of nitrate increases to 37 percent. Excluding the Seaside, Langley and Corral de Tierra subbasins of the Salinas Valley groundwater basin that are not as intensively farmed but are subject to greater potential nitrogen loading from septic systems, the number of wells containing nitrate in excess of the drinking water standard increases to 23 percent. In the Santa Maria groundwater basin, which is also subject to intensive agricultural landuse activities, the percentage of public supply wells containing nitrate in excess of the drinking water standard is considerably higher at 27 percent, with 40 percent under the influence of human sources of nitrate. Data on the Groundwater Ambient Monitoring and Assessment (GAMA) Geotracker system[62] indicate that over 10 percent of public drinking water supply wells in Santa Clara County are impacted with nitrate above the drinking water standard and that upwards of 40 percent are impacted with nitrate at levels of 20 to 45 mg/L nitrate-NO_3. The highest incidence and level of nitrate impacts in Santa Clara County are occurring in the Llagas subbasin.

Local and State Small Water Supply Systems

An evaluation of a water quality data for local (or shared) small water supply system wells (two to four service connections) and state small water supply systems (five to 14 service connections) collected by the Monterey County Health Bureau indicate a slightly increased level of drinking water impact due to nitrate as compared to public supply wells. These smaller water supply systems are typically more susceptible to nitrate impacts due to generally shallower well depths and more rural locations subject to agricultural activity and higher septic system densities. Of the 558 systems sampled (58 percent of 967 systems) during the 2008-2009 fiscal year in Monterey County, 19 percent exceeded the nitrate drinking water standard and 44 percent were under the influence of human sources of nitrate. Average nitrate concentrations for the two system categories were between 59 to 76 percent of the drinking water standard and maximum concentrations ranged from 6.6 to 7.7 times the drinking water standard. Without mapping the various locations of the individual water supply system wells (currently in progress) it is uncertain what percentage of the wells may be impacted from septic systems versus agriculture nitrogen loading. Given a large number of small water supply systems are located within northern portions of the Salinas Valley groundwater basin (Langley subbasin) it is assumed that septic systems are also contributing to nitrate impacts within this area.

Of all the counties in the Region, Monterey County is the only one that requires regular sampling of local small and state small water supply systems to track nitrate and other contaminant (arsenic in particular) concentrations over time. Most of the other counties

[62] http://www.swrcb.ca.gov/gama/grid.shtml

in the region require one time sampling for systems with two to 14 service connections as part of the initial permitting process even though state regulations only require this for systems with five to 14 service connections. This is true for systems with initial sampling data showing elevated nitrate concentrations up to the drinking water standard and even for systems with nitrate concentrations above the drinking water standard that require treatment based on initial permit conditions. With the exception of Monterey County these point of permit water quality data are generally not available in an electronic format that can be readily captured and evaluated. Consequently, the number of small water supply systems impacted with nitrate within the rest of the region is currently uncertain.

Domestic Wells

Individual domestic water supply wells are even more susceptible to nitrate impacts than public or state small water system supply wells given their shallower depths and location within rural areas potentially subject to intensive agricultural land use. This point is illustrated by USGS studies showing that on a national basis approximately seven (7) percent of domestic wells and three (3) percent of public-supply wells tested by USGS contained nitrate in excess of the drinking water standard.[63] There are an estimated 44,000 private domestic water supply wells in the Central Coast Region. An estimated 10,000 to 15,000 domestic wells are located in Monterey County alone. Santa Cruz, Santa Clara, Santa Barbara and Ventura counties all currently require one time sampling for nitrate at the point of permit issuance for domestic wells. Unfortunately, these data are generally not available in an electronic format that can be readily captured and evaluated. Consequently, with the exception of a domestic well study in Santa Clara County, very little is known about the level of nitrate impacts to domestic wells in the Region.

In 1998 the SCVWD conducted a voluntary nitrate sampling program for domestic wells located within the Llagas and Coyote subbasins.[64] The incidence and level of nitrate impacts were most severe within the Llagas subbasin. Evaluation of the data indicated that nitrate contamination was widespread and not restricted to any particular areas. Of the 508 domestic wells sampled in the Llagas subbasin as part of this program, 55.3 percent (281) were impacted with nitrate in excess of the drinking water standard at levels of up to 4.5 times the drinking water standard and average and median nitrate concentrations of 47.7 and 47.0 mg/L nitrate-NO_3, respectively. In addition, 89 percent of the wells sampled within both subbasins contained nitrate in excess of the study area specific background nitrate level of 10 mg/L nitrate-NO_3. Comparison of the 1998 domestic well data with three previous domestic well studies conducted by SCVWD and others indicate that average nitrate concentrations within domestic wells in the Llagas subbasin increased steadily from 19.5 mg/L nitrate-NO_3 in 1963 to 47.7 mg/L nitrate-NO_3 in 1998. The relative percentage of wells impacted with nitrate in excess of the

[63] Dubrovsky, N.M et al., 2010, The quality of our Nation's waters—Nutrients in the Nation's streams and groundwater, 1992–2004: U.S. Geological Survey Circular 1350, 174 p. (http://water.usgs.gov/nawqa/nutrients/pubs/circ1350)
[64] Santa Clara Valley Water District, 1998. Private Well Water Testing Program; Nitrate Data Report.

drinking water standard also increased from 11.3 to 55.3 percent in the Llagas subbasin during this time period.

In 2006 the SWRCB GAMA program conducted a domestic well study in Tulare County.[65] This study showed that 41 percent of the domestic wells sampled contained nitrate in excess of the drinking water standard. This study also showed similar statistics regarding the number of public and small water system wells impacted with nitrate as discussed above for portions of the Region. A GAMA domestic well study is currently pending for Monterey County.

A national study by USGS analyzing water quality data from 2,167 domestic wells collected as part of the National Water-Quality Assessment Program (NAWQA) concluded nitrate was present at concentrations greater than the drinking water standard more frequently in agricultural areas than in other land-use settings.[66] According to the USGS report, nitrate concentrations were more frequently greater than the drinking water standard in areas of agricultural land use (7.1 percent) than in areas of urban (3.1 percent), mixed (3.7 percent), or undeveloped (0.7 percent) land use. In addition, NAWQA studies showed that 23.4 percent of wells in specifically targeted regional areas of agricultural land use were impacted with nitrate above the drinking water standard.

Based on these studies it is reasonable to assume that upwards of 40 percent of the domestic wells within agricultural areas of the Region may be impacted with nitrate in excess of the drinking water standard. Applying the most conservative USGS estimate of 7.1 percent regionally would result in approximately 3,100 domestic wells in the region impacted with nitrate in excess of the drinking water standard.

Salinas Valley basin

The Monterey County Water Resources Agency (MCWRA) has been sampling wells in the Salinas Valley since 1978 documenting nitrate impacts to groundwater. An analysis and comparison of the two most recent nitrate sampling events, 370 wells in 1993 and 152 wells in 2007, by MCWRA document the most widespread and severe nitrate impacts to groundwater within the Region.[67] Most of the wells sampled were agricultural irrigation wells. With the exception of the semi-confined pressure 400 foot and deep aquifers, the incidence of agricultural wells impacted with nitrate in excess of the drinking water standard has increased in all subbasins and aquifer zones within the Salinas Valley groundwater basin between 1993 and 2007. The unconfined aquifers of the East Side, Forebay and Upper Valley subbasins are the most severely impacted with 60, 54 and 68 percent of the wells sampled in these subbasins, respectively, being

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[65] http://www.swrcb.ca.gov/water_issues/programs/gama/domestic_well.shtml

[66] DeSimone, L.A., 2009, Quality of water from domestic wells in principal aquifers of the United States, 1991–2004: U.S. Geological Survey Scientific Investigations Report 2008–5227, 139 p., available online at http://pubs.usgs.gov/sir/2008/5227

[67] MCWRA, 2010, Technical Memorandum - NITRATE Tasks 2.01, 2.02, 2.04.2b, EPA Grant XP-96995301 - Groundwater Sampling, Reporting, and Storage, Groundwater Sampling, Data QA/Qc, Data Reduction and Representation

impacted with nitrate in excess of the drinking water standard at maximum levels of 6.4 to 11.2 times the drinking water standard (2007 sampling event). The highest documented nitrate concentration in the Region was detected in the Upper Valley subbasin during the 1993 sampling event at levels of 677 mg/L nitrate-NO_3 (over 15 times the drinking water standard). Excluding wells within the semi-confined pressure 400 foot and deep aquifers, 51 percent of the wells sampled in the Salinas Valley were impacted with nitrate in excess of the drinking water standard during the 2007 sampling event. For the wells sampled in the East Side, Forebay and Upper Valley subbasins, mean nitrate concentrations ranged from 1.8 to 2.4 times drinking water standard and median nitrate concentrations ranged from 1.2 to 1.7 times the drinking water standard. In addition, comparison of the 1993 and 2007 nitrate data for all wells sampled indicate significant increasing trends in mean and median nitrate concentrations by subbasin of up to 38 and 27 mg/L nitrate-NO_3, respectively. Although not discussed, a figure/map contained within the MCWRA technical memorandum indicates increasing nitrate concentration trends in a significant number of wells within the East Side, Forebay and Upper Valley subbasins that were sampled during both the 1993 and 2007 sampling events.

For many of the wells within the Salinas Valley the observed nitrate impacts are likely a result of nitrate loading that occurred years or even decades ago. Large-scale agricultural activity began in the Salinas Valley in the early 1900's and grew at a modest rate up until the 1940's when use of irrigation water and fertilizer accelerated. Review of available data show that nitrate concentrations in wells increased modestly from the 1950's through the 1960's and then generally increased dramatically beginning in the 1970's and 1980's. The apparent lag in increasing nitrate impacts is consistent with modeling studies indicating that nitrate leaching to groundwater can take between 10 to 50 years depending soil type, aquifer heterogeneity, depth to the water table, relative amounts of clean and nitrate laden recharge, and nitrate attenuation within the vadose zone.[68] [69] Nonetheless, nitrate loading studies discussed within this report indicate that nitrate loading in the Salinas Valley is ongoing and significant. Elevated nitrate concentrations within shallow groundwater, indicative of young (recently recharged) groundwater, also indicate more recent and ongoing nitrate loading. Nitrate concentrations within three shallow monitoring wells screened within perched groundwater at about 10 to 15 feet below ground surface in an area completely surrounded by row crops regularly contain nitrate at levels of up to 300 to 500 mg/L nitrate-NO_3.[70] Preliminary data from a LLNL special study in the Salinas Valley also indicate relatively "young" groundwater ages of about five years in shallow wells sampled in the Arroyo Seco area containing nitrate concentrations in excess of three times the drinking water standard. Nitrate isotope analyses of the Arroyo Seco area

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[68] Fogg et al. 1999, Groundwater Vulnerability Assessment: Hydrogologic Perspective and Example from Salinas Valley, California, Hydrologic Sciences, University of California, Davis, CA

[69] Fogg et al., 1995, Matrix Diffusion and Contaminant Transport in Granular Geologic Materials, with Case Study of Nitrate Contamination in the Salinas Valley, California, Final Technical Report submitted to MCWRA and USGS in fulfillment of Water Resources Research Award No. 14-08-0001-G1909

[70] Axiom Engineers, 2010, D'Arrigo Brothers Annual Monitoring Report

well samples also indicate that the elevated nitrate concentrations detected in these wells are primarily attributable to ammonium fertilizer.

Llagas subbasin

According to the SCVWD 2009 Groundwater Quality Report, nitrate impacts the largest number of wells tested within Santa Clara County relative to all other contaminants.[71] Wells sampled within the Llagas subbasin (located within the Gilroy-Hollister groundwater basin) during 2009 showed the highest incidence and level of nitrate impacts as compared to the Santa Clara and Coyote subbasins (northern subbasins not within the Central Coast Region). A combination of SCVWD monitoring wells and water supply wells were sampled within the two, shallow and deep, aquifer zones within the subbasin. Within the principle [deeper] aquifer zone of the Llagas subbasin, 19 percent of the 67 wells sampled for nitrate exceeded the nitrate drinking water standard (second to perchlorate at 2 percent) and within the shallow aquifer zone, 55 percent of the 11 wells sampled exceeded the nitrate drinking water standard. Median nitrate concentrations were 30 and 51.5 mg/L nitrate-NO_3 and the maximum nitrate concentrations were 155 and 187 mg/L nitrate- NO_3 for the principle and shallow aquifer zones of the subbasin, respectively.

The 2009 SCVWD report also included nitrate trend analyses for wells that were sampled multiple times between 2000 and 2009. In the shallow aquifer zone of subbasin, 21 percent of the 19 wells sampled showed increasing nitrate trends while 5 percent showed decreasing trends between 2000 and 2009, whereas within the principle [deeper] aquifer zone, only 8 percent of the 95 wells sampled showed increasing trends while 16 percent showed decreasing trends. The estimated magnitude of the increasing trends ranged from 0.6 to 10 mg/L nitrate-NO_3 per year and the median rate of change was 2 mg/L nitrate-NO_3 per year. Improved groundwater quality (decreasing nitrate trends) in portions of the Llagas basin are likely attributable to changes in land use away from agriculture to commercial, urban and rural development as well as the importation and recharge of water from the State Water Project (SWP) and Central Valley Project (CVP).

A 2005 LLNL study indicates the shallow aquifer is highly vulnerable to nitrate impacts because of high vertical recharge rates and rapid lateral transport and that the dominant source of nitrate in the shallow aquifer is synthetic fertilizer.[72] Based on groundwater ages (determined by geochemical fingerprinting techniques) in relation to nitrate levels this study also indicates that the implementation of a nitrate management program in 1997 has not yet resulted in a decrease in the flux of nitrate to the shallow aquifer in the areas tested. For example, groundwater ages in shallow aquifer wells sampled as part of this study east of Gilroy that contained nitrate concentrations exceeding twice the drinking water standard were determined to be less than seven years old and in some

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[71] Santa Clara Valley Water District, March 2010, 2009 Groundwater Quality Report.
[72] Moran, J. E. et al., 2005. California GAMA Program: Sources and transport of nitrate in shallow groundwater in the Llagas Basin of Santa Clara County, California. July 2005.

locations less than two years old. These data indicate that the nitrate impacts are due to more recent loading and not that of legacy farming practices.

Pajaro Valley basin

Although evidence indicates nitrate impacts to groundwater are significant within the Pajaro Valley basin, only limited data, figures and general references are publicly available documenting the extent and severity of the problem in this basin. Section 3 of the 2002 Pajaro Valley Water Management Agency (PVWMA) 2002 Basin Management Plan[73] provides a general description of nitrate impacts indicating that elevated nitrate concentrations in excess of the drinking water standard are typically observed in wells west of Highway 1, in the wells east of the City of Watsonville and in other localized areas. This document further states that, “because agriculture is the major land use in the Pajaro Valley, elevated nitrate concentrations are likely due to fertilizer application and agricultural practices.” Figure 3-1 of the Basin Management Plan shows an increasing incidence and level of nitrate impact within wells sampled between 1979 and 1998. Evaluation of the figure indicates up to 19 wells sampled between 1993 to 1998 contained nitrate at concentrations of 135.1 to 486.0 mg/L nitrate-NO_3 (3 to 10.8 times the drinking water standard). A June 2009 PVWMA PowerPoint figure mapping nitrate well data throughout the basin indicates that approximately 70 of 182 wells sampled (38.5 percent) contained nitrate in excess of the drinking water standard.[74] Staff are currently working with PVWMA to obtain groundwater quality data for the Pajaro groundwater basin. The PVWMA reportedly implements a groundwater monitoring program that samples and tracks approximately 170 selected production wells and monitoring wells throughout the basin.

Santa Maria River Valley basin

Historically, the Santa Maria Valley Groundwater Basin has been subject to high nitrate concentrations, particularly in the vicinity of the Cities of Santa Maria and in Guadalupe and nitrate concentrations have been recorded as high as 240 mg/L nitrate-NO_3. [75] [76] Staff evaluated data collected between 1985 and 2000. Groundwater nitrate concentrations in the Santa Maria Valley were elevated, with numerous sites consistently exceeding the drinking water standard.[77] More recent study of available data indicate nitrate concentrations in shallow groundwater in the Santa Maria Valley Management Area (SMVMA) have progressively increased during the period from the 1970’s through 2009 resulting in municipal water purveyors having to reduce or cease pumping from water supply wells with shallow zone screen intervals in or order to

[73] http://www.pvwma.dst.ca.us/basin_management_plan/bmp_documents.shtml
[74] PVWMA 2009, Powerpoint Figure/Map – Nitrate as NO3, Groundwater Monitoring Results, June 30, 2009.
[75] SBCWA. 1999 and 2001. Santa Barbara County 1999 and 2001 Groundwater Reports
[76] DWR. 2002. Water Resources of the Arroyo Grande-Nipomo Mesa Area. Southern District Report. 166 p.
[77] Central Coast Regional Water Quality Control Board (CCRWQCB), 1995. Assessment of Nitrate Contamination in Ground Water Basins of the Central Coast Region – Preliminary Working Draft, December, 1995

comply with drinking water standards.[78] In contrast to widespread elevated nitrate concentrations in shallow groundwater, nitrate concentrations in deeper portions of the aquifer are generally lower.

Bolsa, Hollister and San Juan Bautista Area groundwater subbasins (San Juan Bautista and Hollister areas)

The December 2007 San Benito County Water District Annual Groundwater Report for Water Year 2007, San Benito County, reports that in the northern areas of the basin (Bolsa), water quality has remained stable in recent years (2004-2007), but that other areas, such as the eastern portion of the San Juan Bautista Area subbasin, have shown variable and increasing trends in key constituents like nitrate and chloride in selected monitoring wells. Average nitrate concentrations within each of the seven subbasins within San Benito County ranged from 18 to 36 mg/L nitrate-NO_3. Although these average values are below the drinking water standard, they all indicate impacts above background levels. In addition, one of the highest recorded nitrate concentrations in the Region was detected in a shallow well in the eastern San Juan subbasin at levels of over 650 mg/L nitrate-NO_3 (over 14 times the drinking water standard). A DWR analysis of public supply well data collected between 1994 and 2000 for the San Benito County portion of the Gilroy-Hollister groundwater basin indicated that approximately 23 percent of the public supply wells contained nitrate in excess of the drinking water standard. [79]

2.3 Health Impacts from Nitrate

Nitrate contamination of groundwater used as a drinking water supply is a significant public health concern.

Nitrogen is essential for all living things as it is a component of protein. Nitrogen exists in the environment in many forms and changes forms as it moves through the nitrogen cycle. For most people, consuming small amounts of nitrate is not harmful. However, excessive concentrations of nitrate-nitrogen or nitrite-nitrogen in drinking water can be hazardous to health, especially for infants and pregnant women. For this reason, the U.S. Environmental Protection Agency (U.S. EPA) has established a maximum contaminant level (MCL) of 10 mg/L nitrate-N (45 mg/L nitrate-NO_3).

The nitrite oxidizes iron in the hemoglobin of the red blood cells to form methemoglobin, which lacks the oxygen-carrying ability of hemoglobin. This creates the condition known as methemoglobinemia (sometimes referred to as "blue baby syndrome"), in which blood lacks the ability to carry sufficient oxygen to the individual body cells causing the veins and skin to appear blue. While acute health effects from excessive nitrate levels in drinking water are primarily limited to infants (methemoglobinemia or "blue baby

[78] Luhdorff and Scalmanini Consulting Engineers, April 2010, 2009 Annual Report of Hydrogeologic Conditions, Water Requirements, Supplies, and Disposition, Santa Maria Valley Management Area.

[79] DWR, 2004, Gilroy-Hollister Valley Groundwater Basin, San Juan Bautista Area Subbasin, DWR Bulletin 118

syndrome"), evidence suggests there may also be adverse health effects among adults as a result of long-term ingestion exposure, and in older individuals who have genetically impaired enzyme systems for metabolizing methemoglobin. Generally, families drawing their water supply from farm areas experience the greatest exposure to elevated nitrate concentrations in drinking water.[80]

A recent study[81] suggests that low doses of nitrate can also have serious effects on the brain. Nitrate concentrations of 4 mg/L nitrate-N or more in rural drinking-water supplies have been associated with increased risk of non-Hodgkin's lymphoma. Additionally, researches from the University of Iowa found that up to 20 percent of ingested nitrate is transformed in the body to nitrite, which can then undergo transformation in the stomach, colon, and bladder to form N-nitroso compounds[82]. These compounds are known to cause cancer in a variety of organs in more than 40 animal species, including higher primates.

2.4 Pesticides

Available data indicate that irrigated agriculture is also responsible for the presence of low levels of various pesticides within domestic and public water supply wells in areas of intensive agricultural land use. As with fertilizer application, pesticide application within major agricultural areas occurs regularly over areas encompassing thousands of acres overlying various groundwater basins. The pesticides contained within agricultural runoff linked to aquatic toxicity as discussed above in the Surface Water Quality discussion are also susceptible to leaching to groundwater.

The California Department of Pesticide Regulation (DPR) monitors for pesticides/herbicides (collectively called pesticides) in shallow groundwater in the Central Coast Region as well as other regions in the state. DPR's regulatory approach includes designating areas in the state where groundwater is most vulnerable to pesticide contamination from leaching and runoff, with prescribed actions to prevent pesticides from reaching groundwater in those areas. Vulnerable areas are classified as either "runoff" or "leaching" and regulations include various options to manage application of pesticides. DPR determined vulnerable areas, or "Ground Water Protection Areas (GWPAs)" via statistically relating areas having historical pesticide detections in groundwater with associated soil type, farming practices, depth to groundwater (70 feet or less), and climate information. DPR determined that in hardpan soils, the principle transport pathway is rainfall runoff to dry wells, ditches, sumps, ponds, soils with deep cracks, or neighboring coarse soils. For coarse (sandy) grained

[80] R. B. Brinsfield and K. W. Staver, *Addressing groundwater quality in the 1990 farm bill: Nitrate contamination in the Atlantic Coastal Plain*, Journal of Soil and Water Conservation, March 1990, vol 45., no. 2, 285-286.

[81] M.H. Ward, Mark S.D., Cantor K.P., et al., *Drinking Water Nitrate and the Risk of Non-Hodgkin's Lymphoma*, Journal of Epidemiology and Community Health, 1996, Vol. 7, pgs 465-471.

[82] Peter Weyer, *Nitrate in Drinking Water and Human Health*, 2001, http://www.agsafetyandhealthnet.org/Nitrate.PDF

soils, leaching is the principle contaminant pathway and irrigation water is the main driver for movement of pesticides to groundwater. Different management practices are applied to the leaching and runoff areas. In the Central Coast Region, groundwater protection areas have been identified for areas within San Luis Obispo and Monterey counties. The GWPA maps can be viewed on DPR's website.[83]

In San Luis Obispo County, DPR identifies GWPAs attributed to leaching vulnerability located south of Arroyo Grande, west of Nipomo Mesa, and north of the Santa Maria River. In Monterey County, GWPAs attributed to leaching are scattered along the Salinas River. The vulnerable areas appear to be associated with shallow groundwater and permeable soils adjacent to the Salinas River. DPR also identified four small runoff protection areas, in addition to the "leaching" protection areas.

Since the Pesticide Contamination Prevention Act was passed in 1985, only eight active ingredients in currently registered pesticides have been found in groundwater due to legal agricultural use (use means pesticide application according to law and label directions). These include Atrazine (Aatrex), Simazine (Princep), Bromacil (Hyvar, Krovar), Diuron (Karmex, Krovar), Prometon (Pramitol), Bentazon (Basagran), Norflurazon (Solicam, Predict, Zorial), and permits are needed to use any of these listed pesticides in a groundwater protection area, along with a "use requirement" option. DPR also monitors for pesticide active ingredients in groundwater that have the potential for migration to groundwater based on a threshold value. The threshold value is based on physical and chemical properties or method of application of the pesticide. A pesticide is thought to have a potential to leach to groundwater if it is mobile (e.g., high solubility, low soil adsorption coefficient) and persistent (slow degradation rates). If the pesticide is intended to be applied or injected into the soil by ground-based equipment or by chemigation, or if the product label requires or recommends that the applications be followed, within 72 hours, by flood or furrow irrigation, then DPR also monitors for that pesticide in groundwater.

According to a 2007 DPR report, pesticide detections in groundwater are rare in the Central Coast Region's groundwater. For instance, in fiscal year 2007, of 313 wells sampled in counties within the Central Coast Region, 6 (1.9 percent) wells had unverified pesticide detections, with no (0) verified detections. This compares to a total of 3,290 wells sampled in the state with 411 (12.5 percent) unverified detections, and 61 (1.9 percent) verified detections. A verified detection means that it was detected by two different laboraties or independent samples.

Staff evaluated historical DPR pesticide sampling and analyses results for groundwater monitoring conducted between 1984 and 2009. Method detection levels (MDLs) ranged between .01 and 1 micrograms per liter for reported pesticides. Not counting petroleum related compounds (benzene, xylene, and naphthalene), that are commonly used as fungicides, and chloromethane (common laboratory contaminant), the three pesticides/pesticide degradates with the highest detection frequency were chlorthal-dimethyl and degradates (total), TPA (2,3,5,6-tetrachloroterephthalic acl) and carbon

[83] http://www.cdpr.ca.gov/docs/emon/grndwtr/gwpamaps.htm

disulfide. The following table summarizes the data by county in the Central Coast Region:

Table 2.4: Summary of Department of Pesticide Regulation (DPR) groundwater pesticide sampling data from 1984 to 2009

County	Number of Wells Sampled	Total Number of Samples	Number of Unverified and Verified Detects	Detection Frequency (percent)	Number of Wells w/detects
San Benito	77	288	0	0%	0
San Luis Obispo	291	1601	30	1.9%	26 (8.9%)
Monterey	751	3547	93	2.6%	52 (6.9%)
Santa Barbara	298	1423	21	1.5%	16 (5.4%)
Santa Cruz	200	1373	125*	9.1%	23 (11.5%)
Santa Clara	304**	3545	18	0.5%	16 (5.3%)
Total	1,921	11,777	287	2.4%	133 (6.9%)

Table Notes:

*includes several detections of gasoline constituents (benzene and xylene)

**includes wells in Region 2.

Evaluation of these data indicate a slightly higher incidence of pesticide impacts when including both verified and unverified detections as compared to the 2007 DPR report; 2.4 percent of samples collected between 1984 and 2009 contained verified or unverified detections of pesticides (287 of 11,777 samples). The highest detection frequencies occurred in Santa Cruz, Monterey and San Luis Obispo counties at 9.1, 2.6 and 1.9 percent, respectively, of samples collected containing pesticides. Pesticide impacts to groundwater appear more severe based on the percentage of wells sampled with pesticide detections. Region wide, 6.9 percent of wells sampled between 1984 and 2009 contained pesticides (133 of 1,921 wells). Santa Cruz, San Luis Obispo and Monterey counties had the highest percentages of wells containing pesticides at 11.5, 8.9 and 6.9 percent, respectively.

Samples collected by DPR containing pesticide concentrations above an applicable preliminary health goal or drinking water standard (MCL) include: ethylene dibromide (2002), atrazine (1993), and dinoseb (1987) in Monterey County; heptachlor (1989), ethylene dibromide (1989) in Santa Barbara County; benzene (various dates 1994-2007), 1,2,4-trichlorobenzene (1991) in Santa Cruz County; ethylene dibromide (1994, 2008, 2009) in San Luis Obispo County; and 1,1,2,2-tetrachloroethane (1998) in Santa Clara County. A total of 38 samples and ten wells contained pesticides in excess an applicable drinking water standards. It should be noted that 27 of the samples exceeded the drinking water standard for benzene, a commonly used fungicide, that may also be attributable to fuel releases from underground storage tanks.

DPR has not identified GWPAs in Santa Barbara County; however, Central Coast Staff evaluated the DPR groundwater monitoring locations in Santa Barbara County, including areas with detected pesticides. DPR areas monitored include the Cuyama Valley, Santa Barabara and Carpenteria areas, Santa Ynez Valley, Lompoc area, portions of the San Antonio watershed, and Santa Maria Valley. Pesticide detections appear clustered in the Lompoc area (southwest corner of township/range 07N34W, two locations in the San Antonio watershed (not many sampling locations there), and a cluster of detections west of US 101 and south of the Santa Maria River in the northwestern corner of township/range 10N34W. All but one of the pesticide detections in Santa Barbara County occurred between 1988 and 1995 and only two compounds, heptachlor and ethylene dibromide, were detected above the drinking water standard (MCL) and preliminary health goal, respectively. These detections occurred in 1989. Inspection of the DPR data set indicates that pesticides are detected sporadically in both space and time within the Salinas Valley.

In a national study of the probability of nitrate contamination in shallow groundwater, the USGS reported that the presence of elevated levels of nitrate in groundwater may also indicate the presence of additional contaminants such as herbicides[84]. The herbacides atrazine, simazine, and deethylatrazine (breakdown product of atrazine) occurred in 1 percent of groundwater samples collected from domestic and public supply wells that also had elevated nitrate concentrations. The DPR dataset for the Central Coast Region only noted 5 detections of atrazine, simazine, and deethylatrazine out of the thousands of samples collected and analyzed (MDL of 0.1 to 1 micrograms per liter).

Results from SWRCB Groundwater Ambient Monitoring and Assessment (GAMA) program studies in the Central Coast Region indicate a much higher incidence of pesticides in groundwater at low levels.[85] [86] GAMA studies implement analytical techniques that achieve ultra-low detection levels of between 0.004 and 0.12 micrograms per liter (generally less than .01 micrograms per liter). Out of 54 wells sampled on a random grid in groundwater basins in the south coast range study unit (Los Osos Valley, San Luis Obispo, Santa Maria River Valley, San Antonio Creek Valley, and Santa Ynez River Valley groundwater basins/subbasins), 28 percent of the wells had 11 pesticide or pesticide degradates detected in groundwater samples, with the three most abundant detections being deethylatrazine (18.5 percent), atrazine (9.3 percent), and simazine (5.6 percent). Including nine “understanding wells” in addition to the “grid” wells, six exceeded the MCL for nitrate; of those six wells, four were also sampled for pesticides, and all four had pesticides detected in the collected samples. Twenty-eight percent of 97 wells sampled in the Monterey Bay and Salinas Valley

[84] Hitt, K.J., and Nolan, B.T., 2005. Nitrate in Ground Water: Using a Model to Simulate the Probability of Nitrate Contamination of Shallow Ground Water in the Conterminous United States. USGS Scientific Investigations Map 2881.
[85] Kulongoski, J.T., and Belitz, K., 2007. Ground-Water Quality Data in the Monterey Bay and Salinas Valley Basins, California, 2005- Results from the California GAMA Program. Data Series 258, USGS.
[86] Mathany, T.M. et al., 2010. Groundwater-Quality Data in the South Coast Range-Coastal Study Unit, 2008: Results from the California GAMA Program. Data Series 504, USGS.

Basins had pesticide detections, including 18 percent for simazine, 11 percent for deethylatrazine, and 5 percent for atrazine. Two wells exceeded the MCL for nitrate; one of those wells was also sampled for pesticides and a pesticide was detected in the sample collected from that well. None of the pesticides detected as part of the GAMA program exceeded a health-based threshold value.

A growing body of evidence has led many experts to suspect that pesticides can attack developing brains, perhaps in the womb or infancy, leading to neurological diseases later in life. An article in Scientific American Newsletter in 2009 reported that “rural residents who drink water from private wells are much more likely to have Parkinson’s disease, a finding that bolsters theories that farm pesticides may be partially to blame…”[87] The study of more than 700 people in the Central Valley of California, found that those who likely consumed contaminated private well water had a higher rate of Parkinson’s. The risk of Parkinson’s was as much as 90 percent higher for those who had private wells near fields sprayed with the widely used insecticides propargite or chlorpyrifos. Chlorpyrifos is one of the most common chemicals causing toxicity in Central Coast surface waters and has not been studied for its presence in ground waters. Most rural residents in the Central Coast region get their drinking water from private domestic wells.

2.5 Groundwater Overdraft, Seawater Intrusion & Salts

Groundwater Overdraft & Seawater Intrusion

Groundwater overdraft is a decrease in groundwater storage within a basin or aquifer that results in a significant prolonged period of groundwater level declines. Along coastal portions of the Region, prolonged periods of groundwater level decline are causing seawater intrusion into aquifers that are hydraulically connected to the ocean. Overdraft can also cause upward or downward migration of poor-quality groundwater, loss of surface water (instream) flows, and land subsidence with corresponding permanent loss of aquifer storage capacity. Overdraft can also result in the concentration of contaminants within a basin.

In many areas within the Region groundwater pumping for agricultural purposes has caused or contributed to overdraft conditions resulting in decreased groundwater levels, decreased aquifer storage and seawater intrusion within various coastal areas. The two most documented examples of seawater intrusion primarily attributable to agricultural groundwater pumping occur within the Pajaro and Salinas Valley groundwater basins. Although primarily attributable to groundwater extraction for municipal supply, seawater intrusion is also documented in the Los Osos Valley groundwater basin. Portions of the Gilroy-Hollister and Santa Maria River Valley basins are or were historically in overdraft

[87] Cone, Marla and Envrionmental Health News. (2009). Scientific American. http://www.scientificamerican.com/article.cfm?id=rural-well-water-insecticides-parkinsons-disease-california

but basin management appears to have stabilized or caused a rebound in groundwater levels within these basins. The Gilroy-Hollister, Salinas Valley, and Santa Maria River Valley groundwater basins are actively managed to enhance groundwater recharge in order to meet pumping demand and to offset pumping via recycled water use but excessive pumping (primarily related to agriculture) continues to cause seawater intrusion into the Salinas and Pajaro groundwater basins, with increasing portions of the basins unusable for agriculture and municipal supply as a result. Surface water diversions from the Salinas Valley Water Project to the Castroville Seawater Intrusion Project have reportedly offset additional pumping west of Salinas that will halt if not push back seawater intrusion in this area. Although these and other related conjunctive use projects can be effective, maximizing irrigation efficiency is essential to minimize saltwater intrusion and other problems associated with overdraft.

Salts

Whereas salt impacts from seawater intrusion as a result of overdraft conditions are generally well defined, non-point source loading of salts and the resulting impacts (increased soil and groundwater salinity) are relatively undefined in the Region. At this time it is speculated that soil and groundwater salinity are also increasing in severity within agricultural areas of the Region, but additional data and evaluation is needed to gain a better understanding of these impacts on a regional basis.

Salt loading/impacts are primarily a result of:

1) Seawater intrusion within coastal groundwater basins/aquifers caused by excessive groundwater pumping resulting in overdraft conditions,
2) Agricultural irrigation that concentrates salts in the vadose zone and aquifers,
3) The importation/discharge of salts into the basin from agricultural soil amendments and fertilizers,
4) The importation of water containing salts,
5) The importation of salts from point source wastewater (both industrial and municipal) and septic system discharges (salts are attributable to soaps/detergents/cleaners, personal care products, dietary salts (cooking), water softeners and food waste).
6) Dissolution of natural minerals or the presence of marine deposits/sediments within the geologic formation

Studies indicate that agricultural operations are the leading source of salt loading to the Salinas and Pajaro Valley groundwater basins.[88] To a much lesser extent, analogous to the nitrate loading estimates, point source wastewater (both industrial and municipal) and septic system discharges also contribute to salt loading to groundwater within localized areas around these discharges.

[88] Association of Monterey Bay Area Governments (AMBAG), October 1978. “Investigation of Nonpoint Source of Groundwater Pollutants in Santa Cruz and Monterey Counties, California.” H. Esmaili and Associates

Areas subject to intensive agriculture are susceptible to increased soil and groundwater salinity, that if significant enough can result in groundwater being unusable for municipal/domestic, industrial and agriculture water supply. Increase groundwater salinity from irrigation can occur over time wherever irrigation occurs since almost all water (even natural rainfall) contains some dissolved salts. When the plants use water, the salts are left behind in the soil and eventually begin to accumulate. Since soil salinity makes it more difficult for plants to absorb soil moisture, these salts must be leached out of the plant root zone by applying additional water. This water in excess of plant needs is called the leaching fraction and can be a significant portion of irrigation requirements. In areas with clay soils, gypsum (calcium sulfate dihydrate - $CaSO_4{\cdot}2H_2O$) is often used to flush accumulated sodium from the clay mineralogy to loosen up, or shrink, the soil and facilitate better drainage. The use of gypsum and other soil amendments and fertilizer formulations also contribute to salt loading. Salination from irrigation water is also greatly increased by poor drainage and use of saline water for irrigating agricultural crops. The United States Department of Agriculture estimates that, worldwide, 10 million hectares of arable land is lost to irrigation salinity every year. Based on severe salinity problems within portions of the Central Valley, significant efforts are currently being implemented by the Central Valley Salinity Coalition and CV-SALTS to organize, facilitate and fund the efficient management of salinity in the Central Valley. In addition, the SWRCB recently adopted the Recycled Water Policy, which calls for the development and implementation of salt and nutrient plans for all of the groundwater basins in the State.

2.6 Conclusions

Nitrate

At this time, the largest contributing source of nitrate loading to groundwater in the Central Coast Region, fertilizer application from irrigated agriculture, is virtually unregulated. Nitrate loading to groundwater from fertilizer application is significant and ongoing and the documented impacts are widespread and severe. The combination of historical and ongoing nitrate loading from fertilizer application continues to impact major portions of entire groundwater basins that act as a sole source of domestic and municipal water supply resulting in a growing and significant number of drinking water systems being impacted with nitrate above the public health drinking water standard. Of particular concern is the potentially significant number of domestic water supply wells impacted with nitrate and the people who are unknowingly drinking water that doesn't meet public health standard for nitrate.

Nitrate contamination of drinking water supplies results in considerable costs to water purveyors and users to treat, blend or otherwise procure alternative water supplies to meet the public health drinking water standard for nitrate. In some cases, water users cannot afford to do this and are forced to purchase bottled water in addition to paying for potable water service that is unsafe to drink. This scenario is particularly true in lower income areas that in some cases ironically consist of agricultural laborers and their families as in the case of the San Jerardo Co-Op and water system. To this point, the nitrate problem is not just a water quality or public health issue, but also an environmental justice issue. Unless the ongoing nitrate loading is significantly reduced or completely stopped, the extent and severity of the impacts to our water supplies will continue to increase along with the costs and human health risks.

Historical sources of nitrate loading, or "legacy" nitrate, is undoubtedly a significant contributing factor to the observed widespread and severe nitrate groundwater impacts within the Region. However, the ongoing and significant discharges of nitrate to groundwater from irrigated agriculture as documented in this report are contributing to an already alarming level of impacts to the beneficial uses of groundwater. Unfortunately, nitrate concentrations are likely to increase in many deeper aquifers over the next several years or even decades even if nitrate loading is completely stopped. This is because high levels of nitrate already in the vadose zone and shallow groundwater will continue to move downward into the aquifers with irrigation return flows and recharge from rainfall or flooding events. Consequently, reduced loading at the ground surface will likely take years to decades to result in lower nitrate concentrations in groundwater because of the typically slow rate of groundwater recharge within many groundwater basins. Nonetheless, significant measures need to be implemented now to reverse the current trend in nitrate loading with the ultimate goal of improved groundwater quality years or even decades in the future.

Although essential in assessing the long-term effectiveness of a program addressing nitrate loading to groundwater from irrigated agriculture, relying on groundwater quality data from deep wells will not be sufficient to track short-term progress in reducing nitrate loading to groundwater. The implementation of specific requirements to reduce and document nitrate loading will need to occur along with groundwater monitoring to achieve the goal of improving water quality over time. To be effective, these requirements need to focus on improvements in both nutrient and irrigation management practices. According to the 1990 Report of the Ad Hoc Salinas Valley Nitrate Advisory Committee prepared by MCWRA, “water and nutrient management are the key components of a successful nitrate contamination prevention program.” Irrigation efficiency is a critical component of nitrate loading because irrigation water is the primary driver for nitrate leaching to groundwater. As such, increased irrigation efficiency coupled with decreased fertilizer-nitrogen application are both necessary to minimize return flow (recharge) of leachate to groundwater containing high concentrations of nitrate. The chemical form of fertilizer-nitrogen applied, the method and timing of application, and the method and timing of irrigation are important factors that need to be considered in minimizing nitrate loading.

In addition to documenting nitrate trends from this point forward, regular groundwater monitoring/sampling of agricultural wells for nitrate is essential to facilitate more efficient nitrogen budgeting by individual growers and for prioritization of implementation efforts by the Water Board. Available water quality data indicate that a large percentage of agricultural wells sampled in the Region produce water containing significant concentrations of nitrate. The nitrate contained within groundwater that is being used for irrigation is available for plant uptake and should be accounted for in fertilizer-nitrogen budgets such that growers are not applying any more nitrogen than needed by a particular crop. Anecdotal evidence suggests that very few growers are accounting for and beneficially using nitrate contained with groundwater used for irrigation. Doing so could significantly reduce the amount of additional fertilizer-nitrogen applied and potentially remediate groundwater over time by mining nitrate from the groundwater basin. Evaluation of nitrate data from agricultural wells will also be essential in identifying high risk areas or wells due to aquifer susceptibility, poorly constructed or operated wells (i.e. fertigation without adequate backflow prevention), or in the vicinity of public or domestic supply wells that need special attention. In summary, regular nitrate sampling and reporting requirements for all agricultural wells is essential to 1) establish baseline nitrate concentrations and evaluate trends from this point forward to document long-term progress towards improved groundwater quality, 2) facilitate the budgeting and use of nitrate contained within pumped groundwater by individual growers to reduce the amount of fertilizer-nitrogen applied, and 3) to identify and prioritize the most problematic agricultural activities and areas within the Region.

It appears very little has been done in the last thirty years to seriously address the nitrate problem since it was definitively identified as the biggest water quality problem in the State as well as within portions of the Region. Research, education, outreach or other voluntary programs directed at reducing nitrate loading to groundwater from irrigated agriculture via improved irrigation and fertilizer efficiency have been or are currently being implemented by various state and federal agencies, particularly CDFA, USDA and U.C Cooperative Extension, as well as local agencies and districts within the Region such as the SCVWD, MCWRA and PVWMA. Although it is speculated that these programs have resulted in some improvements by individual growers or grower associations within various areas to reduce nitrate loading to groundwater, there are currently no data or programs to document this. Although research, education and outreach programs are absolutely necessary for the development and widespread implementation of improved agricultural practices addressing the nitrate problem, they should not be relied on as the sole or primary basis of a program to protect the beneficial uses of groundwater from nitrate contamination.

At this time available data indicate an ongoing and significant trend in nitrate loading to groundwater from irrigated agriculture and an increase in the extent and severity of nitrate impacts to the beneficial uses of groundwater. Nitrate loading to groundwater from irrigated agriculture constitutes a discharge of waste to waters of the State and is subject to waste discharge requirements and enforcement actions pursuant to the California Water Code. Whereas discharges of nitrate to groundwater from municipal, industrial, domestic and other point sources are regulated in the Region, agriculture as been selectively excluded from similar regulation to date. Until such time as this significant gap in regulatory oversight is addressed, beneficial uses of groundwater will not be adequately protected. Consequently, regulatory programs need to be developed requiring the implementation of nitrogen and irrigation management practices to reduce nitrate loading to groundwater and require monitoring to document whether progress is being made to reduce nitrate loading.

Salts

It is widely recognized that irrigated agriculture concentrates salts within the root zone and subsequently leaches them to groundwater. Limited review of available groundwater quality data and literature indicate that salt loading to groundwater from irrigated agriculture is a potentially significant water quality problem in the Region and that it may be an even bigger water quality problem than nitrate loading. To put this in perspective, nitrate behaves like a salt in groundwater and is only one of the numerous constituents that contribute to metrics of salinity like total dissolved solids (TDS) and electrical conductivity (Ec). The potentially significant loading of salt to groundwater from irrigated agriculture warrants the collection and analysis of groundwater quality data for salt constituents and metrics of salinity within and around agricultural areas. In addition to nitrate monitoring and reporting requirements, agricultural supply wells should also be sampled for general chemistry parameters and inorganic constituent (i.e. dissolved constituents that contribute to salinity) to facilitate the evaluation of salt impacts from agricultural leaching on a regional basis. As with nitrate, salt loading from municipal, industrial and other point sources are regulated via waste discharge requirements.

Pesticides

Although numerous well sampling data collected by DPR between 1984 and 2009 indicate pesticides are infrequently detected above preliminary health goals or drinking water standards, the number of wells sampled in the Region containing pesticides during this time period is relatively significant at 6.9 percent. More recent studies by the SWRCB GAMA program indicate even higher incidences of widespread low-level pesticide impacts in agricultural areas with 28 percent of wells sampled within various groundwater basin/subbasins containing selected pesticides at concentrations below standard analytical method detection limits. Available data also indicate a potential correlation between nitrate and pesticide impacts within wells sampled for both nitrate and pesticides. Consequently areas identified as vulnerable to pesticide are also likely to be vulnerable to nutrient and salt impacts and should be closely monitored.

Notwithstanding uncertainty regarding potential health effects from low levels of pesticides in groundwater and the somewhat transient nature of pesticide occurrence in groundwater, the occurrence of pesticides in groundwater is a water quality and public health concern that needs to be addressed. Ongoing work by and coordination with DPR is warranted to protect the beneficial uses of groundwater from pesticide loading. The groundwater vulnerable areas identified by DPR, as well as areas of known pesticide occurrence in groundwater, may be useful in prioritizing regulatory efforts in agricultural areas. In some cases, requirements for individual growers or property owners to sample agricultural and/or drinking water supply wells for various pesticides should be considered based on existing data or the identification of vulnerable areas. However, areas that have not been identified by DPR as vulnerable to pesticide impacts should not be overlooked given GAMA data show more widespread pesticide impacts to groundwater. It should also be noted that DPR requirements for pesticide storage and handling could be applied to fertilizers in order to minimize nitrate loading from spills.

3.0 Aquatic Habitat Conditions

3.1 Importance and Functions of Riparian and Wetland Areas

Wetland and riparian areas are some of the most important ecosystems in a watershed. Ecologically intact riparian and wetland areas play important roles in protecting the Region's beneficial uses designated in the Basin Plan. These beneficial uses include Ground Water Recharge; Fresh Water Replenishment; Warm Fresh Water Habitat; Cold Fresh Water Habitat; Inland Saline Water Habitat; Estuarine Habitat; Marine Habitat; Wildlife Habitat; Preservation of Biological Habitats of Special Significance; Rare, Threatened or Endangered Species; Migration of Aquatic Organisms; Spawning, Reproduction and/or Early Development; and Areas of Special Biological Significance.

Wetland and riparian areas also protect and improve water quality by reducing pollutant loading, such as sediment, and by controlling temperature where vegetation provides shady areas necessary for fish and other aquatic organisms.

The Central Coast Water Board's actions should be focused on reducing pollutant dischargers to valuable and sensitive water bodies, protecting beneficial uses of the waterbodies in the region and achieving our highest priorities, the measurable goals of our Vision. The Healthy Aquatic Habitat Measurable Goal reads: By 2025, 80 percent of Aquatic Habitat is healthy, and the remaining 20 percent exhibits positive trends in key parameters. In order to meet this goal, the Central Coast Water Board must advance and improve protection and restoration of riparian and wetland areas, including through agricultural regulatory programs.

The 2011 Conditional Waiver includes requirements to protect and restore wetlands and riparian areas to prevent discharges of wastes, such as sediment from fields into streams and wetlands, to maintain temperatures healthy for fish and organisms in streams and wetlands, and to increase the value of all the habitats listed in the above beneficial uses.

Wetland areas can protect and improve water quality by reducing pollutant loading (Fisher and Acremen 2004; Mayer 2005; and United States Environmental Protection Agency (USEPA) 2009). Mayer found that water passing through managed wetlands reduced turbidity levels in the Lower Klamath National Wildlife Refuge of southern Oregon and northern California. A 1990 study showed that the Congaree Bottomland Hardwood Swamp in South Carolina removed a quantity of pollutants equivalent to that removed annually by a $5 million wastewater treatment plant. Another study at a 2,500 acre wetland in Georgia, indicated that the filtering action of the wetland saved $1 million in water pollution abatement costs annually (USEPA 2009).

Riparian and wetland areas play an important role in achieving several water quality objectives, including those water quality objectives related to natural receiving water temperature, dissolved oxygen, suspended sediment load, settleable material concentrations, chemical constituents, and turbidity. In particular, seasonal and daily water temperatures are strongly influenced by the amount of solar radiation reaching the stream surface, which is influenced by riparian vegetation. Removal of vegetative canopy along surface waters has a negative impact toward achieving temperature water quality objectives, which in turn negatively affects dissolved oxygen related water quality objectives.

Riparian areas can also improve water quality by trapping sediment and other pollutants contained in terrestrial runoff (NRC 2002; Flosi and others 1998; Pierce's Disease/Riparian Habitat Workgroup PDRHW 2000; Palone and Todd 1998). Palone and Todd (1998) also reported that an intact riparian area helps to decrease the effects of downstream floods by decreasing the rate of water flow, storing floodwaters, and dissipating stream energy, that in turn, increases infiltration.

The Central Coast Water Board supported several wetland restoration planning and implementation projects in the Lower Salinas watershed, beginning with a 205(j) project in 1994, entitled North Salinas Valley Watershed Restoration Plan (restoration plan). This plan laid out a comprehensive approach to protecting and improving water quality in the historical sloughs and wetlands of the area through restoration of "wet corridors" that would function to filter pollutants (nutrients, sediment and pesticides), increase groundwater recharge and improve wildlife
habitat. The restoration plan covered creeks and sloughs that drained to Moss Landing Harbor, including Gabilan Creek, Natividad Creek, Alisal Creek, Tembladero Slough and Moro Cojo Slough. Moss Landing Marine Lab, the Watershed Institute at California State University at Monterey Bay and other partners subsequently implemented the plan with funding from 319(h) and Proposition 13. Approximately 120 acres of wetland and riparian habitat were restored, along with approximately 200 acres of upland habitat, on a combination of public and private lands. The grants incorporated water quality monitoring above and below the restored areas, as well as plant and animal surveys. Generally, the monitoring showed mixed results, with some but not all sites showing decreasing nitrate and turbidity levels. The sites also showed improved habitat value, including increased wetland and riparian vegetation and the presence of several endangered species.
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monitoring above and below the restored areas, as well as plant and animal surveys. Generally, the monitoring showed mixed results, with some but not all sites showing decreasing nitrate and turbidity levels. The sites also showed improved habitat value, including increased wetland and riparian vegetation and the presence of several endangered species. More specific project details are provided below.

The Watershed Institute Division of Science & Environmental Policy at California State University Monterey Bay implemented grant-funded wetland restoration projects in the Gabilan Watershed and surrounding Southern Monterey Bay Watersheds. These wetland restoration projects resulted in improved aquatic habitat conditions measured by favorable changes in populations of native plants and birds. Wetland restoration also improved water quality by reducing sediment loads, removing large fractions of nitrate and suspended sediment inputs, and removal of ammonia, phosphate, and diazinon. A final report that supports these findings can be found on the web at: http://ccwg.mlml.calstate.edu/wp-content/uploads/2008/11/2007_gabilan_fr.pdf.

Coastal Conservation and Research and Moss Landing Marine Laboratories implemented restoration projects in the Moro Cojo Slough. The two research groups learned that agricultural runoff that ran through wetland habitats can result in greatly reduced levels of nitrate. In addition, restoration resulted in better support of native plants and animals. Greater than 40 native plant species and 22 native vertebrates were observed throughout the project sites. In addition, the following protected species were documented throughout the Moro Cojo Watershed: California Red-legged Frog, California Tiger Salamander, Steelhead, Santa Cruz Long-toed Salamander, Tidewater Goby, and Saline Clover. A final report that supports these findings can be found on the web at: http://ccwg.mlml.calstate.edu/wp-content/uploads/2008/11/final_report_moro_cojo.pdf.

The Watershed Institute at California State University Monterey Bay and Moss Landing Marine Laboratories studied changes in stream turbidity in restoration sites in the Hansen Slough area near Watsonville. The study concluded that stream turbidity decreased by more than 50-fold when comparing restoration project sites above and below restored areas. Nitrate concentrations also decreased as water passed through the restoration area – nitrate concentrations entering the site exceeded 140 mg/L and levels leaving the site never exceeded 40 mg/L, and were frequently below 5 mg/L. A final report that supports these findings can be found on the web at: http://ccwg.mlml.calstate.edu/wp-content/uploads/2008/11/comprehensivewatershedmanagemensolutionstononpointsourcepollutioninthesalinasvalleypajaroriverbasin1997.pdf

In the absence of human alteration, riparian areas can form dense thickets of vegetation that have deep root systems. This vegetated system serves to stabilize banks from erosion (NRC 2002). Riparian and wetland areas can be an effective tool in improving agricultural land management. Wide riparian areas act as buffers to trees and debris that may wash in during floods, thereby offsetting damage to agricultural fields and improving water quality (Flosi and others 1998; PDRHW 2000). Further, agricultural floodplains are approximately 80 to 150% more erodible than riparian forest floodplains (Micheli and others 2004).

Riparian forests also provide as much as 40 times the water storage, relative to a cropped field (Palone and Todd 1998). The water stored in wetland and riparian areas can contribute base flow to a stream during times of the year when surface water would otherwise cease to flow (DWR 2003).

Riparian trees block solar radiation from streams, thereby helping to maintain water temperature. (Naiman 1992; PDRHW 2000). Naiman (1992) found that lack of riparian canopy can change water temperature in summer by 3 to 10 degrees within a 24-hour period due to increased direct solar radiation. Regulating instream temperature is important to the existence of instream organisms because it affects their metabolism, development and activity (Naiman 1992). Cool water helps to maintain dissolved oxygen levels, high levels of which are critical to the survival of oxygen-consuming organisms (PDRHW 2000).

Conversion from native, multi-layered, riparian vegetation to a non-native species monoculture, such as a grass species, can also result in lack of shade, woody debris, and leaf litter that contribute food and instream habitat complexity for salmonids and other species (California Department of Fish and Game 2003). Leaf litter from riparian vegetation is the primary driver of most stream ecosystems (Palone and Todd 1998). Stream ecosystems in turn support broadly based food webs that support a diverse assemblage of wildlife (NRC 2002).

Palone and Todd (1998) also reported that when riparian trees are removed, populations of aquatic insects decline or disappear, and in turn, wildlife that may depend on them also disappears. Some insects adapted to specific tree species cannot survive when fed the leaves of exotic grasses.

More than 225 species of birds, mammals, reptiles, and amphibians depend on the riparian habitat of California. The most diverse bird communities in the arid and semiarid portions of the western United States are found in riparian ecosystems (RHJV 2004). The U.S. Fish and Wildlife Service reports that up to approximately 43 percent of federally threatened and endangered species depend directly or indirectly on wetlands for their survival (United States Environmental Protection Agency 2008). Of all the states, California has the greatest number of at-risk animal species (15) and the greatest number of at-risk plant species (104) occurring within isolated wetlands (Comer and others 2005).

Riparian vegetation may play a role in integrated pest management. Cavity-nesting riparian bird species prey on rodents and pest insects in agricultural fields (PDRHW 2000), thereby reducing the need for poison and pesticide use on agricultural lands, and protecting water quality as a result.

Intermittent and ephemeral headwater streams play important roles in protecting water quality. Alterations to headwater streams and wetlands can lead to detrimental changes in habitat features affecting aquatic and terrestrial wildlife. Changes to headwater streams, including from agricultural operations, can lead to downstream eutrophication, coastal hypoxia, and an increase in nutrient loading (Freeman and others 2007).

3.2 Current Conditions of Riparian and Wetland Habitat

California has lost an estimated 91 percent of its historic wetland acreage, the highest loss rate of any state. Similarly, California has lost between 85 and 98 percent of its historic riparian areas (State Water Resources Control Board, 2008).

Agricultural areas often border and encroach upon riparian and wetland areas. In addition to the historical clearing of riparian and wetland habitat to allow for cultivation and staging areas at field perimeters, some growers have scraped 30-foot wide borders to create bare soil around field edges, have cleared trees, plants and brush from creeks and ditches, and have applied poison into and along surface waters to kill wildlife, all in an effort to keep wildlife from coming near their agricultural fields (Estabrook, 2008; Slater, 2009). Staff expects that growers will continue to alter riparian and wetland areas due to food safety pressures, unless regulatory agencies successfully apply sufficient pressure in the opposite direction.

After the tragic September 2006 outbreak of E. coli 0157:H7 in spinach, where four people died, California's agricultural industry developed the California Leafy Greens Marketing Agreement (LGMA) and associated metrics to decrease the risk of such contamination happening again. Unfortunately, alongside the development of the LGMA metrics, a competition has developed among buyers and retailers to lay claim to the "safest" food by calling for increased requirements that go above and beyond what is called for in the LGMA metrics. These market-driven practices (known as "supermetrics") have resulted in large expanses of bare dirt buffers, miles of deer fences along riparian and migration corridors, and water conveyance systems void of vegetation where it previously existed.

According to a spring 2007 survey by the Resource Conservation District of Monterey County, 19% of 181 respondents said that their buyers or auditors had suggested they remove non-crop vegetation from their ranches. In response to pressures by auditors and/or buyers, approximately 15% of all growers surveyed indicated that they had removed or discontinued use of previously adopted environmental practices. Grassed waterways, filter or buffer strips, and trees or shrubs were among the environmental practices removed (RCDMC, 2007). According to a follow-up spring 2009 survey by the Resource Conservation District of Monterey County, growers are being told by their auditors and/or buyers that wetland or riparian plants are a risk to food safety (RCDMC, 2009). As a result farmers are removing wetland and riparian plants in order to be able to sell their food.

A recent aerial survey and comparison was conducted by the Wild Farm Alliance, a non-profit, conservation-based, agriculture group to demonstrate the differences in vegetation before and after the fall 2006 E. coli 0157:H7 outbreak. Below are two images taken along the same riparian corridor of the Salinas River. The first picture was taken before the 2006 outbreak and shows an intact riparian corridor. The second picture was taken in 2008 after buyers and sellers started requiring more stringent buffer requirements and shows were the same riparian vegetation has been removed.

Salinas River Riparian Corridor before the 2006 E. coli 0157:H7 outbreak.
2005 National Agriculture Imagery Program

Salinas River Riparian Corridor after the 2006 e. coli 0157:h7 outbreak.
2008 -Jitze Couperus/Lighthawk

Exhibit 6

AGRANCHID	AW_NUM	RANCH_NAME	RANCH_CITY	IRRIGATED_ACRES	TAILWATER_ACRES	CROP_TYPE	ROWCROP1	ROWCROP2	ROWCROP3	SPECIFIC_CHEMICAL_USE	RANCH_FARM_TIER
20003134	AW0140	Branciforte Ridge Vineyard	Santa Cruz	2.24	0	VINEYARD					1
20012706	AW0142	Terry Binsaca Ranch - Location 07	Soledad	10	0	ROW	Squash	Pepper, Fruiting	Bean, Dried		1
20012703	AW0142	Schipper Ranch Location #10	Soledad	44	0	ROW	Peas	Carrot	Broccoli		1
20012707	AW0142	Vosti Ranch Location #12	Soledad	8	0	ROW	Broccoli	Cucumber	Pepper, Fruiting		1
20012708	AW0142	DeCarli Ranch	Soledad	19	0	ROW	Broccoli	Lettuce, Head	Peas		1
20012702	AW0142	Pura Ranch Location #11	Greenfield, CA	34.5	0	ROW	Lettuce, Head	Peas	Broccoli		1
20000484	AW0146	Homestead Olive Ranch	Templeton	2	0	ROW, ORCHARD	Corn, Human Con.	Walnut	Olive		1
20000777	AW0157	Yano Farms, Inc.	Carpinteria	8	0	NURSERY, ORCHARD	Avocado				1
20000774	AW0157	Yano Farms, Inc.	Carpinteria	4	0	NURSERY, ORCHARD	Avocado				1
20000780	AW0157	Yano Farms, Inc.	Carpinteria	1	0	NURSERY, ORCHARD	Avocado				1
20006900	AW0160	Ma Vigne Au Soleil	Templeton	8		VINEYARD					1
20001079	AW0163	Burnett Ranch	San Juan Bautista	40		ROW	Celery	Lettuce, Leaf	Pepper, Fruiting		1
20001081	AW0163	Flocken	San Juan Bautista	30		ROW, ORCHARD	Apple	Celery	Lettuce, Leaf		1
20001096	AW0163	Bozo/Fields	Watsonville	20	0	ROW	Broccoli	Cauliflower	Lettuce, Head		1
20001097	AW0163	Milladan	Watsonville	34	7	ROW	Broccoli	Celery	Cauliflower		1
20001094	AW0163	Madesko	Watsonville	0	0	ROW	Cauliflower	Celery	Lettuce, Head		1
20001092	AW0163	Vucovich	Watsonville	25		ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		1
20001101	AW0163	Pajaro	Watsonville	54	54	ROW	Lettuce, Leaf	Lettuce, Head	Celery		1
20001100	AW0163	Marinovich	Watsonville	20	20	ROW	Lettuce, Leaf	Celery	Lettuce, Head		1
20001085	AW0163	Peterson	San Juan Bautista	40		ROW	Celery	Lettuce, Leaf			1
20001083	AW0163	Union Road	Hollister	6	0	ORCHARD	Apple				1
20008368	AW0163	Bernie Ranch	San Juan Bautista	26	26	ROW	Celery	Lettuce, Head	Lettuce, Leaf		1
20008173	AW0165	Good Plants	Arroyo Grande	1.3	0	GREENHOUSE					1
20001635	AW0165	Ball FloraPlant	Arroyo Grande	4.3	0	GREENHOUSE					1
20007529	AW0166	Quinn Vineyards East	San Miguel	113	0	VINEYARD					1
20007530	AW0166	Quinn Vineyards West	Paso Robles	44	0	VINEYARD					1
20006380	AW0167	Clos Pepe Vineyards	Lompoc	35	7	VINEYARD, ORCHARD	Grapes, Wine	Olive			1
20001496	AW0168	Big Basin Vineyards	Boulder Creek	10	0	VINEYARD					1
20007824	aw0172	San Antonio Valley Vineyards	Bradley	20	0	VINEYARD					1
20003252	AW0175	Old School House Vineyard	Templeton	17.8	0	VINEYARD					1
20003248	AW0175	Snow Vineyard	Paso Robles	14.24	0	VINEYARD					1
20003245	AW0175	Mustang Springs	Paso Robles	22.76	0	VINEYARD					1
20003251	AW0175	Mustard Creek Vineyard	Paso Robles	8.36	0	VINEYARD					1
20007199	AW0180	POS	Santa Maria	43	43	ROW	Strawberry				1
20003125	AW0182	Keyes Valley Ranch	san Miguel	325	0	ROW, VINEYARD	Barley	Grapes, Wine	Oat		1
20003657	AW0185	Sunview Shandon Ra 44 East	Shandon	123	0	VINEYARD					1
20003653	AW0185	Sunview Shandon Ra 44 west	Shandon	82	0	VINEYARD					1
20003639	AW0185	Sunview Shandon Ra 37	Shandon	209	0	VINEYARD					1
20003650	AW0185	Sunview Shandon Ra 48	Shandon	143	0	VINEYARD					1
20003642	AW0185	Sunview Shandon Ra 47	Shandon	143	0	VINEYARD					1
20005402	AW0189	Watsonville	Watsonville	20	12	NURSERY					1
20005380	AW0189	Salinas 1	Salinas	34	27	NURSERY, GREENHOUSE					1
20007137	AW0200	Swanton Pacific Ranch	Davenport	60	60	ROW	Apple				1
20004398	AW0201	Brand Flower Farms	Carpinteria	60	10	ROW, NURSERY, GREENHOUSE	Other				1
20004400	AW0201	Lilydale	Carpinteria	7	0	GREENHOUSE					1
20003308	AW0203	PR 18	Paso Robles	53.21		VINEYARD					1
20003303	AW0203	PR 16	Paso Robles	42.8		VINEYARD					1
20003305	AW0203	PR 17	San Miguel	73.74		VINEYARD					1
20003302	AW0203	PR 15	Paso Robles	109		VINEYARD					1
20003319	AW0203	GV 9	Greenfield	181.99		VINEYARD					1
20003318	AW0203	GV 8	Greenfield	101.16		VINEYARD					1
20003314	AW0203	GV 5	Greenfield	38.82		VINEYARD					1
20003312	AW0203	GV 3	Greenfield	55.35		VINEYARD					1
20003291	AW0203	PR 3 and PR 4	Paso Robles	120.75		VINEYARD					1
20003309	AW0203	PR 19	San Miguel	45.36		VINEYARD					1
20003294	AW0203	PR 6	Paso Robles	144.16		VINEYARD					1
20003292	AW0203	PR 5	Paso Robles	140.97		VINEYARD					1
20003316	AW0203	GV 6 and 7	Greenfield	141.84		VINEYARD					1
20003322	AW0203	GV 11	Greenfield	33		VINEYARD					1
20003320	AW0203	GV 10	Greenfield	34.6		VINEYARD					1
20003299	AW0203	PR 12	San Miguel	131.3		VINEYARD					1
20003297	AW0203	PR 10	Paso Robles	92.64		VINEYARD					1

20003296	AW0203	PR 9	Paso Robles	97.25		VINEYARD				1
20003290	AW0203	PR 2	Paso Robles	67.4		VINEYARD				1
20003289	AW0203	PR 1	Paso Robles	68.04		VINEYARD				1
20003301	AW0203	PR 14	Paso Robles	302.44		VINEYARD				1
20003313	AW0203	GV 4	Greenfield	96.08		VINEYARD				1
20003311	AW0203	GV 1 and 2	Greenfield	108.97		VINEYARD				1
20003300	AW0203	PR 13	Creston	168.5		VINEYARD				1
20003295	AW0203	PR 7	Paso Robles	70.79		VINEYARD				1
20003298	AW0203	PR 11	Paso Robles	57.45		VINEYARD				1
20001620	AW0208	Last Frontier Vineyards	Creston	35.5	0	VINEYARD				1
20000856	AW0214	Guerra Ranch	Morro Bay	18	0	ORCHARD	Avocado			1
20006320	AW0216	Lockwood Oaks Vineyard	Lockwood	83	0	VINEYARD				1
20001123	AW0220	Keisyn Vineyard	templeton	14.05	0	VINEYARD				1
20001129	AW0220	Pomar Junction Vineyard	Templeton	97	0	VINEYARD, ORCHARD				1
20001131	AW0220	Brohaugh Vineyard	Paso Robles	33	0	VINEYARD				1
20004680	AW0222	Foothill	Carpinteria	7	0	GREENHOUSE				1
20003374	AW0228	Andreoli Vineyards & Orchards	San Miguel	4	0	VINEYARD				1
20005202	AW0229	Windmill Nursery	Buellton	4	4	NURSERY, GREENHOUSE				1
20008108	AW0232	Green House Ranch	Salinas	43	43	ROW	Bean, Unspecified	Lettuce, Head	Lettuce, Leaf	1
20008104	AW0232	Long	Salinas	48	48	ROW	Lettuce, Leaf	Lettuce, Head	Bean, Unspecified	1
20001734	AW0232	Tarp	Salinas	36		ROW	Strawberry			1
20003217	AW0233	Firestone Vineyards	Los Olivos	325		VINEYARD				1
20003219	AW0233	Lincourt	Solvang	25		VINEYARD				1
20003476	AW0235	Moss Ridge Vineyard	Paso Robles	7.2	0	VINEYARD				1
20000879	AW0240	Still Waters Vineyards	Paso Robles	60	0	VINEYARD				1
20009362	AW0242	Home Ranch	Oceano	10	10	ROW	Broccoli	Cauliflower	Potato	1
20009363	AW0242	Dominion Ranch	Santa Maria	20	0	ROW	Broccoli			1
20000713	AW0243	Four Elements Organics	Atascadero	5	0	ORCHARD	Apple	Citrus	Pear	1
20000512	AW0245	Winfield Farm	Buellton	12		ROW, ORCHARD, GREENHOUSE	Corn, Human Con.	Tomato	Onion, Dry	1
20003767	AW0251	Hess Vineyard	Soledad	340	0	VINEYARD				1
20003769	AW0251	Deadmans Gulch Vineyard	san Ardo	63	0	VINEYARD				1
20003756	AW0251	Marks Vineyard	Greenfield	396	0	VINEYARD				1
20003770	AW0251	Vineyard Library #3	Soledad	55	0	VINEYARD				1
20003768	AW0251	RS Property I	Soledad	150	0	VINEYARD				1
20003766	AW0251	Vineyard Library #2	Soledad	162	0	VINEYARD				1
20003763	AW0251	Porter Smith I	Bradley	107	0	VINEYARD				1
20003761	AW0251	Smith and Lindley Vineyard	Soledad	340	0	VINEYARD				1
20003752	AW0251	Vineyard Library #1	Soledad	196	0	VINEYARD				1
20003760	AW0251	Porter Smith II	Bradley	97	0	VINEYARD				1
20003759	AW0251	RLS Vineyard	Greenfield	282	0	VINEYARD				1
20003758	AW0251	Cobblestone Vineyard	Greenfield	43	0	VINEYARD				1
20003757	AW0251	RS Property II	Greenfield	64	0	VINEYARD				1
20003751	AW0251	Paraiso Vineyards	soledad	254	0	VINEYARD				1
20003765	AW0251	Porter Smith I	Bradley	189	0	VINEYARD				1
20003754	AW0251	Vineyard Library #4	Greenfield	71	0	VINEYARD				1
20003762	AW0251	San Ardo Sue	San Ardo	30	0	VINEYARD				1
20000587	AW0252	Calzada Ridge Vineyard	Santa Ynez	0.5	0	VINEYARD				1
20003155	AW0253	Claxton Agro	Santa Ynez	42	0	VINEYARD				1
20001553	AW0257	Grimm Farm	Goleta	9	9	ORCHARD	Avocado			1
20002609	AW0265	Russell East South	Shandon	44	0	ROW	Carrot			1
20002607	AW0265	Russell trees	Shandon, CA	50	0	ORCHARD				1
20002608	AW0265	Russell West	Shandon	46	0	ROW	Carrot			1
20002611	AW0265	Sinton 1 South	Shandon	55	0	ROW	Carrot			1
20002414	AW0268	PRESTON FARMS	PASO ROBLES	26	0	VINEYARD				1
20007177	AW0271	Emerald Hills Vineyard	Paso Robles	20	0	VINEYARD				1
20007796	AW0272	linda coyle	goleta	7	7	ORCHARD				1
20007289	AW0273	Luv-a-Duck	Templeton	5.72	0	VINEYARD				1
20000600	AW0281	SVP Winery Vineyards	Shandon	100	0	VINEYARD	Grapes, Wine			1
20000795	AW0284	Ardillas	Nipomo	12	0	ROW	Strawberry	Strawberry	Strawberry	1
20007481	AW0286	Wafelbakker vineyard	Morgan Hill	0.5	0	VINEYARD				1
20003998	AW0292	LDC Ranch/Denier Farms	Goleta	68	136	ORCHARD	Avocado	Lemon		1
20007080	AW0294	Creek Lot	Carpinteria	0.5		ORCHARD	Avocado			1
20008582	AW0298	Galarneau Walnuts	Buellton	16	0	ORCHARD	Walnut			1

20004937	AW0298	Rancho La Vina/walnuts	Lompoc	152	0	ORCHARD	Walnut			1
20007191	AW0298	Rancho La Vina/grapes	Lompoc	35	0	VINEYARD	Grapes, Wine			1
20007190	AW0298	Rancho La Vina/hoops	Lompoc	24	0	ROW	Tomato	Squash, Summer	Peas	1
20005064	AW0301	Via Vega Vineyard	Paso Robles	15		VINEYARD				1
20002092	AW0302	Evenson Ranch	San Miguel	10	0	VINEYARD	Grapes, Wine			1
20000857	AW0305	O'Neill Vineyards	Paso Robles	157	157	VINEYARD	Grape			1
20000706	AW0310	Paraiso Ranch	Soledad	45	0	VINEYARD				1
20009602	AW0311	Arita Hills	Buellton	11.25	0	VINEYARD	Grapes, Wine	Grapes, Wine		1
20000677	AW0315	Rancho Rio Conejo	Cayucos	37	0	ORCHARD				1
20005165	AW0316	Monte & Cathy Lamb Vineyard	San Miguel	4.5	0	VINEYARD				1
20005156	AW0316	Estrella Valley Vineyard	San Miguel	36	0	VINEYARD				1
20005171	AW0316	Emerald hills Vineyard	Paso Robles	21	0	VINEYARD				1
20005152	AW0316	Brave Oak Vineyard, LLC	Paso Robles	78	0	VINEYARD				1
20001744	AW0324	Chesebrough Farm	Templeton	10	0	ROW	Corn, Human Con.	Pumpkin	Squash	1
20003494	AW0327	Salinas Transplant Company	Salinas	9.3		GREENHOUSE				1
20000785	AW0331	Jack R. Amon	Santa Ynez	5	0	NURSERY	Raspberry			1
20003239	AW0332	James Berry Vineyard	Paso Robles	50	0	VINEYARD				1
20007751	AW0334	San Juan Bautista	San Juan Bautista	300	300	ROW	Other			1
20003439	AW0335	Vogelzang Vineyard	Santa Ynez	80	0	VINEYARD				1
20001380	AW0338	Prestons' Vineyard	Templeton	3	3	VINEYARD				1
20002644	AW0342	Camp Six Ranch	San Miguel	5.25	0	VINEYARD	Grapes, Wine			1
20001702	AW0343	Alfred Fiscalini Ranch	Cambria	5	0	ORCHARD				1
20001705	AW0344	Wayne L. and Kathleen M. Gerhardt	Cambria	4.5	0	ORCHARD				1
20000902	AW0347	GH Holdings LP	San Miguel	69	0	VINEYARD				1
20000904	AW0347	Shale Oak Vineyard	Paso Robles	4.53	0	VINEYARD				1
20002242	AW0348	Fitzhugh Quarter Circle Flying W Ranch	Cambria	2	0	ORCHARD	Avocado	Citrus	Apple	1
20004031	AW0349	POMAR RIDGE OLIVE FARM	TEMPLETON	4	0	ORCHARD	Olive			1
20000884	AW0350	Fitzhugh Hill Ranch	Cambria	1	0	ORCHARD				1
20001523	AW0351	Van Wingerden Ranch 4444	Carpinteria	20		ORCHARD	Avocado	Other		1
20001530	AW0351	Live Oak	Nipomo	12		GREENHOUSE	Other			1
20001529	AW0351	Van Wingerden Ranch Nipomo 1	Nipomo	64		ORCHARD	Avocado			1
20007299	AW0352	John Bognuda Farms	Arroyo Grande	40	0	ROW	Oat			1
20001604	AW0352	PORTER RANCH CO LLC	ARROYO GRANDE	40	0	ROW	Oat			1
20001138	AW0353	Valhalla Vineyards	Paso Robles	14	0	VINEYARD				1
20007167	AW0354	2G Roses	Royal Oaks	6	6	GREENHOUSE				1
20002401	AW0355	Nona Vineyards	San Miguel	15	0	VINEYARD	Grapes, Wine			1
20002640	AW0356	Judith Starr	Paso Robles	34.5	0	VINEYARD				1
20003597	AW0357	Encino Grande Ranch	Cayucos	19	0	ORCHARD				1
20001517	AW0358	Hunt Ranch	Templeton	2	0	ORCHARD				1
20000661	AW0359	Del Giorgio Ranch	Carpinteria	23	0	ORCHARD	Avocado			1
20000641	AW0361	Twin Fawns Vineyard	San Miguel CA	52	0	VINEYARD				1
20007882	AW0364	Andy Poteete	San Simeon	15	0	ORCHARD	Avocado			1
20002924	AW0367	Kokopelli vineyards	paso robles	0	0	VINEYARD				1
20003847	AW0379	RANCH 03 (HUTCHERSON)	SANTA MARIA	0	0	ROW	Strawberry			1
20002645	AW0382	Kathryn Bell Limon Avocado Grove	Morro Bay	10	0	ORCHARD				1
20004880	AW0385	Clos LaChance Estate Vineyards	San Martin	91	29	VINEYARD				1
20008536	AW0385	Ukestad Vineyard	San Martin	1		VINEYARD				1
20004894	AW0385	Clos LaChance Cordevalle Estates Vineyards	San Martin	53	0	VINEYARD				1
20004555	AW0386	Chamisal Vineyards	San Luis Obispo	82	0	VINEYARD	Grapes, Wine			1
20000986	AW0387	Paradise Valley Vineyards	Morgan Hill, Ca	0.5	0	VINEYARD	Grapes, Wine			1
20003082	AW0398	Meeker Vineyards	San Miguel	110	0	VINEYARD				1
20003168	AW0399	Foletta Property	San Ardo	40		ORCHARD				1
20000971	AW0402	Bootjack ranch	Paso Robles	155	155	VINEYARD, ORCHARD	Grapes, Wine	Olive		1
20007633	AW0402	Heart Hill Vineyard	Paso Robles	46	46	VINEYARD	Grapes, Wine			1
20004718	AW0404	Betita Parcel	Arroyo Grande	4.9	0	ROW	Chinese Cabbage	Other		1
20004714	AW0404	Cecchetti Parcel	Arroyo Grande	17	0	ROW	Cabbage	Chinese Cabbage	Other	1
20004717	AW0404	Saari Parcel	Arroyo Grande	7.1	0	ROW	Chinese Cabbage	Other	Bean, Unspecified	1
20004715	AW0404	Kawaguchi Parcel	Arroyo Grande	8.7	1	ROW	Brussel Sprout	Bean, Unspecified	Other	1
20004719	AW0404	Reyes Parcel	Arroyo Grande	7	1	ROW	Chinese Cabbage	Brussel Sprout	Other	1
20004025	AW0405	MIKE JACKSON FARMS	CAYUCOS	40	0	ORCHARD	Avocado			1
20003837	AW0408	nojoqui falls	gaviota	35	0	ROW	Onion, Dry	Pepper, Fruiting	Parsley	1
20003730	AW0408	rhoads ave	santa barbara	6	0	ROW	Celery	Cucumber	Lettuce, Leaf	1
20003729	AW0408	st athanasius church	santa barbara	14	0	ROW	Celery	Cucumber	Lettuce, Leaf	1

20003717	AW0408	jeff james	goleta	1.5	0	ROW	Tomato	Pepper, Fruiting	Peas	1
20003823	AW0408	fred meyer	santa barbara	4	0	ROW	Celery	Cucumber	Lettuce, Leaf	1
20003830	AW0408	el cap	goleta	12	0	ROW	Peas	Tomato	Pepper, Fruiting	1
20003716	AW0408	la goleta	goleta	8	0	ROW	Cauliflower	Kale	Tomato	1
20003731	AW0408	#50	goleta	12	0	ROW	Celery	Lettuce, Leaf	Squash	1
20003727	AW0408	stan giorgi	santa barbara	12.5	0	ROW	Carrot	Cabbage	Kale	1
20003720	AW0408	720 ward drive	santa barbara	38	0	ROW	Carrot	Cabbage	Bean, Unspecified	1
20003833	AW0408	arrella	goleta	4	0	ROW	Tomato	Peas	Bean, Unspecified	1
20003905	AW0411	PJ Foley Ranching	Carpinteria	10	0	ORCHARD				1
20003908	AW0411	Bailard Boys Ranch formerly Ranch #2	Carpinteria	15	0	ORCHARD				1
20007711	AW0416	Same	Carpinteria, Ca	3	0	NURSERY, ORCHARD				1
20004230	AW0421	Singleton home	Hollister	2	0	ORCHARD	Walnut			1
20001901	AW0427	Patterson Ranch #2	Goleta	1.5		ORCHARD	Avocado			1
20001902	AW0427	Hollister Ranch #4	Goleta	64		ROW, ORCHARD	Lemon	Squash	Cucumber	1
20000800	AW0431	Asegra Ranch	Summerland	3	5	NURSERY				1
20007383	AW0432	Maximum Nursery Inc	Carpinteria	4.5	0	GREENHOUSE				1
20007382	AW0432	Maximum Nursery Inc	Carpinteria	12	0	ROW, ORCHARD	Avocado			1
20004561	AW0438	Ing Estates Vineyard	Lockwood	40	40	VINEYARD				1
20001066	AW0443	Clearwater	Nipomo	65	10	NURSERY				1
20000436	AW0445	Ackerman Acres	Nipomo	8	8	ROW, ORCHARD	Avocado	Lemon		1
20005192	AW0446	succulent gardens,inc.	castroville	2	2	NURSERY, GREENHOUSE				1
20004547	AW0447	KITAGAWA NURSERY, INC.	CARPINTERIA	8.5	0	NURSERY, ORCHARD, GREENHOUSE	Other	Avocado		1
20004700	AW0449	Serena Ranch	Carpinteria	10	10	ORCHARD	Avocado			1
20004693	AW0449	Hilltop Ranch	Carpinteria	10	10	ORCHARD	Avocado	Citrus		1
20007628	AW0458	Midnight Cellars, INC.	Paso Robles	28	0	VINEYARD				1
20004007	AW0460	San Carlos/Featherhill Ranch	Santa Barbara	110.85	0	ORCHARD	Avocado	Citrus		1
20000888	AW0461	Faith Vineyard	Los Olivos CA	6.5	0	VINEYARD				1
20005007	AW0468	Buttonwood Farm	Solvang	46	0	ROW, VINEYARD, ORCHARD	Peach	Grapes, Wine	Tomato	1
20000848	AW0472	Jones Ranch	Morro Bay	6	0	ORCHARD				1
20002181	AW0473	Alan Eto	Los Osos	14	0	ROW	Peas	Bean, Dried		1
20002656	AW0475	Reinhard Pistachios	Paso Robles	6	0	ORCHARD				1
20003159	AW0476	Pine Hawk Vineyards	San Miguel	57	0	VINEYARD				1
20000687	AW0478	Vistosa Orchard	Santa Barbara	1	1	ORCHARD	Avocado			1
20003800	AW0479	Plantel Nurseries, Inc.	Santa Maria	8.6	0	NURSERY, GREENHOUSE	Other			1
20003803	AW0479	Plantel Nurseries, Inc. Garey	Santa Maria	13.1	0	NURSERY, GREENHOUSE	Other			1
20003809	AW0479	Clark Ave.	Santa Maria	101.4	80	ROW, NURSERY, GREENHOUSE	Raspberry	Blackberry	Other	1
20005203	AW0481	Bourdet Ranch	Hollister	173		ROW	Tomato	Other		1
20005089	AW0481	Flynn Ranch	Hollister	41		ROW	Tomato	Lettuce, Leaf	Other	1
20005142	AW0481	Vosti Ranch	Hollister	49		ROW	Tomato	Lettuce, Leaf	Other	1
20005073	AW0481	DeBrito Ranch	Hollister	3		ORCHARD				1
20005109	AW0481	McCloskey Ranch	Hollister	119		ROW	Tomato	Squash	Other	1
20004994	AW0481	Brigantino Ranch	Hollister	25	0	ROW, ORCHARD	Tomato	Other	Squash	1
20005166	AW0481	Yuste Ranch	Hollister	26		ROW	Peas	Tomato	Other	1
20005017	AW0481	Bertuccio Orchard	Hollister	55		ORCHARD				1
20001299	AW0486	Shady Glenn Farms	Nipomo	0.5	0	ROW	Squash			1
20001500	AW0488	581 Foothill Road	Hollister	5.5	0	ORCHARD	Other			1
20001499	AW0488	100 Arroyo Seco	Hollister	4.9	0	ORCHARD	Other			1
20001491	AW0488	341 Arroyo Seco	Hollister	4.5	0	ORCHARD	Other			1
20001495	AW0488	140 Arroyo Seco	Hollister	3.6	0	ORCHARD	Other			1
20001488	AW0488	835 Foothill Road	Hollister	3.5	0	ORCHARD	Other			1
20001493	AW0488	61 Arroyo Seco	Hollister	4.6	0	ORCHARD	Other			1
20003615	AW0489	Home Ranch	Carmel Valley	1.5	0	ORCHARD	Olive			1
20005087	AW0490	Shinta Kawahara Company Incorporated	Watsonville	27	0	ROW	Strawberry			1
20004768	AW0491	Harvest Moon Vineyards	Gilroy	10		VINEYARD				1
20005281	AW0494	Vintage Organics, Inc	San Luis Obispo	65		ROW, ORCHARD	Artichoke	Other		1
20004279	AW0497	Susan Lyon	Cayucos	23.7	0	ORCHARD				1
20000928	AW0500	Brosseau Ranch	Soledad	36	0	VINEYARD				1
20004353	AW0501	Sun Coast Growers	Salinas	39	0	ROW, NURSERY, GREENHOUSE	Celery	Lettuce, Leaf	Broccoli	1
20004581	AW0507	Morro North	Morro Bay	11.6	0	ORCHARD				1
20005129	AW0509	Rancho Mora	Santa Barbara	10.8	0	ROW	Avocado			1
20003739	AW0513	Estrella Farms	San Miguel	18	0	VINEYARD, ORCHARD	Grapes, Wine	Olive		1
20004046	AW0514	Greenheart Farms Inc, Freitas Nursery	Guadalupe	4	0	NURSERY				1
20004041	AW0514	Greenheart Farms Inc, Arroyo Grande	Arroyo Grande	17.43	0	NURSERY, GREENHOUSE				1

20004081	AW0515	Ball Tagawa Growers	Arroy Grande	6	0	NURSERY, GREENHOUSE				1
20007835	AW0518	Central Coast Sod, Inc	Santa Maria	70	0	NURSERY				1
20007310	AW0519	Foothill Flowers	Carpinteria	10	0	NURSERY, ORCHARD	Avocado	Other		1
20005051	AW0520	Hicks Ranch	Salinas	28.3	0	ROW	Broccoli	Celery	Strawberry	1
20001271	AW0522	GGG Grove	Santa Barbara	1.9	0	ORCHARD	Avocado			1
20001147	AW0525	Labrador Canyon	Carpinteria	1.5		VINEYARD, ORCHARD	Avocado			1
20005120	AW0526	Held Ranch Cordoza Ranch	Cayucos	35	0	ORCHARD				1
20005116	AW0526	Held Ranch Cayucos Creek	Cayucos	70	0	ORCHARD				1
20007287	AW0531	Rose Story Farm	Carpinteria	15	0	ORCHARD	Avocado			1
20007752	AW0532	Tichenor Avocado	San Luis Obispo	26	0	ORCHARD				1
20003081	AW0534	Home Vineyard	Paso Robles	94.1	0	VINEYARD				1
20003080	AW0534	Villa Toscana Vineyard	Paso Robles	52.9	0	VINEYARD				1
20007707	AW0542	MacElvaine Ranch	Morro Bay	24	24	ORCHARD	Avocado			1
20000511	AW0548	Evans Ranch	Morro Bay	46	0	ROW, VINEYARD, ORCHARD	Pepper, Fruiting	Squash, Summer		1
20001310	AW0549	Erro Ranch	Cuyama	1269.39		ROW	Carrot	Bean, Unspecified	Barley	1
20001309	AW0549	Brash Ranch	Ventucopa	78.49		ROW	Carrot	Barley		1
20001313	AW0549	Hub Russell Ranch SLOC	New Cuyama	1356.28	0	ROW	Barley	Carrot	Bean, Unspecified	1
20001314	AW0549	Joe Russell Ranch	New Cuyama	905.6	40	ROW	Carrot	Other		1
20001315	AW0549	Serrano / Richards Ranch	Cuyama	119.68		ROW	Carrot			1
20001318	AW0549	Wegis Triangle E Ranch	Cuyama	97.02		ROW	Carrot			1
20001316	AW0549	Virgilio Ranch	Ozena	143		ROW	Carrot	Bean, Dried	Barley	1
20007766	AW0550	Peck-Clark-Gruenhagen Ranch 2	Shandon	0	0	ROW	Other			1
20007721	AW0550	Peck Ranch 1	Shandon	0	0	ROW	Other			1
20002591	AW0550	Rohnert	Hollister	30.7	30.7	ROW	Lettuce, Leaf	Mustard	Spinach	1
20002592	AW0550	Wright	Hollister	47.1	47.1	ROW	Lettuce, Leaf	Mustard	Spinach	1
20002590	AW0550	S. Pura	Hollister	29.4	29.4	ROW	Lettuce, Leaf	Mustard	Spinach	1
20011422	AW0550	Doud Ranch 12	King City	40	40	ROW	Broccoli			1
20003824	AW0551	DuPont	Watsonville	240	20	ROW	Brussel Sprout			1
20003821	AW0551	Delucchi	Watsonville	74	20	ROW	Brussel Sprout			1
20002658	AW0556	macfarms	Morro Bay	8	0	ORCHARD	Avocado			1
20001164	AW0559	Erro Ranch	Cuyama	363.9		ROW	Carrot	Barley		1
20001167	AW0559	Hub Russell Ranch SLOC	New Cuyama	2093.66	80	ROW	Carrot	Bean, Unspecified	Barley	1
20001226	AW0559	Serrano / Richards Ranch	Cuyama	307.19		ROW	Carrot	Barley		1
20001259	AW0559	Harvey Russell Ranch Continued	New Cuyama	0		ROW	Carrot			1
20001198	AW0559	Hub Russell Ranch SBC	New Cuyama	0		ROW	Carrot	Bean, Unspecified	Barley	1
20001236	AW0559	Tut Ranch	Cuyama	373.68		ROW	Carrot	Barley		1
20001201	AW0559	Harvey Russell Ranch	New Cuyama	1491.93		ROW	Carrot	Barley	Other	1
20005441	AW0561	Chateau Margene	Creston	5.5	5.5	VINEYARD	Grapes, Wine			1
20002965	AW0562	Sunset Hill Ranch Vineyard	San Miguel	3	0	VINEYARD	Grapes, Wine			1
20007814	AW0563	Robert King	CARPINTERIA	6	6	NURSERY				1
20007720	AW0570	Song's Flowers	Santa Maria	6	0	NURSERY				1
20000564	AW0571	Hidden Springs Tree Farm	atascadero	10	0	ORCHARD				1
20004244	AW0572	Bamboo Giant Nursery, Inc.	Aptos	17	0	NURSERY				1
20002926	AW0573	Paso del Sol	Paso Robles	4		VINEYARD				1
20006141	AW0577	Endow Nursery	Carpinteria	7	7	NURSERY, GREENHOUSE				1
20004996	AW0578	NAGAMINE	WATSONVILLE	7.5	0	GREENHOUSE				1
20003931	AW0586	Bell Tower Ranch	Morro Bay	3.4		ORCHARD				1
20007424	aw0592	Blackjack Ranch Vineyard	solvang	16	9	VINEYARD				1
20008532	aw0593	Jeff ELings	Santa Barbara	5	0	ORCHARD	Avocado			1
20003066	AW0599	Carhartt Vineyard	Solvang	9.63	0	VINEYARD	Grapes, Wine			1
20003413	AW0602	Los Alisos Ranch	Santa Barbara	65	0	ORCHARD	Avocado			1
20007161	AW0604	Royal Oaks Wineery	Santa Ynez	22		VINEYARD	Grapes, Wine			1
20001237	AW0608	Madaline Vineyard	Gilroy	4.5	0	VINEYARD				1
20007926	AW0608	Dos Ninas Vineyards	Gilroy	7	0	VINEYARD				1
20005001	AW0609	Steve Scheftic	Santa Barbara	3	0	ORCHARD	Avocado			1
20010722	AW0612	Dubost Ranch	paso Robles	5		VINEYARD, ORCHARD				1
20007221	AW0614	LOJACONO VINEYARD	TEMPLETON	40	0	VINEYARD				1
20004264	AW0616	Bosio FamilyPartnership & RDA-CoOwners	Santa Barbara	215	0	ORCHARD	Avocado			1
20001163	AW0622	Mac Brown Inc	Ventura	45	0	ORCHARD				1
20007883	AW0623	same	Cayucos	25	25	ROW	Squash	Peas		1
20001457	AW0624	Ranch #3-Main Yard	Gilroy	40	0	NURSERY	Collard			1
20007412	AW0628	DEBRILEY RANCH	Santa Barbara	7	7	ORCHARD	Avocado			1
20004701	AW0630	Cascade Ranch	Pescadero	100	100	ROW	Brussel Sprout	Peas	Pumpkin	1

20000792	AW0632	Bear Valley Vineyards	Parkfield	51	0	VINEYARD				1
20007411	AW0634	Sweet Ranch	Santa Margarita	6		ORCHARD				1
20004325	AW0635	Old Creek Ranch	Cayucos	30	0	ROW, ORCHARD	Avocado	Citrus		1
20009162	AW0637	Cal-Orchid, Inc.	santa barbara	2	0	GREENHOUSE	Other			1
20001545	AW0640	Central Coast Wilds	Santa Cruz	1	1	NURSERY				1
20008170	AW0641	Lazy F Vineyard	Lompoc	41	0	VINEYARD				1
20003696	AW0641	Rideau Vineyard	Solvang	13.5	0	VINEYARD				1
20003681	AW0641	Rio Vista Vineyard	Buellton	68	0	VINEYARD				1
20003684	AW0641	Tierra Alta Vineyard	Los Olivos	61	0	VINEYARD				1
20004012	AW0641	Estelle Vineyard	Santa Ynez	78	0	VINEYARD				1
20003693	AW0641	Morman's Vineyard	Lompoc	13	0	VINEYARD				1
20003701	AW0641	Stag Canyon Vineyard	Santa Ynez	4.5	0	VINEYARD				1
20003708	AW0641	Great Oaks Vineyard	Santa Ynez	35	0	ROW, VINEYARD	Pastureland			1
20004015	AW0641	Evans Vineyard	Santa Ynez	1.6	0	VINEYARD				1
20002971	AW0641	Vie Caprice	Santa Ynez	2.6	0	VINEYARD				1
20003685	AW0641	Fe Ciega Vineyard	Lompoc	11	0	VINEYARD				1
20002967	AW0641	La Barge Vineyard	Lompoc	12	0	VINEYARD				1
20003688	AW0641	Fox Family Vineyard	Santa Ynez	3	0	VINEYARD				1
20000665	AW0644	Edna Station	San Luis Obispo	1.25	0	ROW	Blueberry			1
20004873	AW0646	Maria Ygnacia Ranch	Santa Barbara	27	0	ORCHARD				1
20004117	AW0649	WAUGAMAN	WATSONVILLE	21.24		ROW	Raspberry			1
20004110	AW0649	CHURCH	WATSONVILLE	46.88		ROW	Raspberry			1
20004114	AW0649	DALTON 2	WATSONVILLE	56		ROW	Raspberry			1
20004096	AW0649	HILL	WATSONVILLE	6		ROW	Raspberry			1
20004047	AW0649	HOME	WATSONVILLE	27		ROW	Raspberry			1
20004104	AW0649	BRAYCOVICH	WATSONVILLE	38		ROW	Raspberry			1
20004109	AW0649	DALTON	WATSONVILLE	52		ROW	Raspberry			1
20004100	AW0649	KETT	WATSONVILLE	55		ROW	Raspberry			1
20004103	AW0649	BUCHWALD	WATSONVILLE	20		ROW	Raspberry			1
20004106	AW0649	PAVLEY	WATSONVILLE	20		ROW	Raspberry			1
20004112	AW0649	PLANT SCIENCES	WATSONVILLE	28		ROW	Raspberry			1
20004119	AW0649	CASSERLY	WATSONVILLE	31		ROW	Raspberry			1
20004120	AW0649	SILVA	WATSONVILLE	10		ROW	Raspberry			1
20004134	AW0649	RIDER-HOME	WATSONVILLE	27		ROW	Raspberry			1
20004132	AW0649	RIDER	WATSONVILLE	6		ROW	Raspberry			1
20004128	AW0649	SHIKUMA 1 & 2	WATSONVILLE	65		ROW	Raspberry			1
20004123	AW0649	CROWN	WATSONVILLE	19		ROW	Raspberry			1
20004141	AW0649	YAMAMOTO	WATSONVILLE	25.5		ROW	Raspberry			1
20004140	AW0649	YAMAMOTO	WATSONVILLE	5.25		ROW	Raspberry			1
20004095	AW0649	MORESCO	WATSONVILLE	30		ROW	Raspberry			1
20010362	AW0649	KETT2	WATSONVILLE	112.3		ROW	Raspberry			1
20004055	AW0649	SCURICH	WATSONVILLE	18		ROW	Raspberry			1
20000721	AW0651	Panziera	Salinas	500	0	VINEYARD, ORCHARD				1
20000724	AW0651	Binsacca	Soledad	270	0	VINEYARD, ORCHARD				1
20000725	AW0651	Las Alturas	Soledad	98	0	VINEYARD				1
20000716	AW0651	Clark & Telephone	Santa Maria, CA	148	0	VINEYARD				1
20000717	AW0651	Tunnel	Santa Maria	48	0	VINEYARD				1
20000720	AW0651	Onteveros	Santa Maria	90	0	VINEYARD				1
20004942	AW0654	Greenhouse Ranch	salinas	32	32	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	1
20004551	AW0655	Janet M Hope	Paso Robles	19	0	VINEYARD				1
20003461	AW0657	Wild Horse Vineyard	Templeton	43	20	VINEYARD	Grapes, Wine			1
20004091	AW0659	Ranchita Canyon Vineyard	San Miguel	74	0	VINEYARD, ORCHARD	Grapes, Wine	Olive		1
20003272	AW0660	Gerhard Schlecht	Los Gatos	2.5	0	VINEYARD				1
20001707	AW0662	R&E Ranch	Paso Robles	34	0	VINEYARD	Grapes, Wine			1
20003643	AW0663	Mitchella	Paso Robles	20	0	VINEYARD	Grapes, Wine			1
20004187	AW0670	Home Ranch	Santa Cruz	43.5	43.5	ROW	Brussel Sprout	Leek		1
20004174	AW0670	Petes Upper	Santa Cruz	23.7	23.7	ROW	Brussel Sprout	Leek		1
20005747	AW0673	Conlan Ranch	Salinas	35	15	ROW	Strawberry			1
20004753	AW0674	Hansen Vineyards	Templeton	20	0	VINEYARD				1
20002947	AW0675	EZ1 Vineyard	Creston	47.26	0	VINEYARD				1
20007434	AW0678	Van Wingerden Ranch / Color Spot	Carpinteria	8.5		ROW, GREENHOUSE	Other			1
20002789	AW0680	Figueroa Farms	Santa Ynez	23	0	ORCHARD	Olive			1
20002883	AW0681	Ranch 9	Salinas	91	0	ROW	Other			1

20012483	AW0681	Ranch 7a PERENNIAL	Gonzales	189.5	0	ORCHARD				1
20001689	AW0682	FOREST NURSERY PASO	PASO ROBLES	8	8	NURSERY				1
20001686	AW0682	FOREST NURSERY LOS OSOS	LOS OSOS	12	6	NURSERY				1
20008159	AW0684	Ranch 2	Goleta	56		ORCHARD	Avocado			1
20008154	AW0684	Ranch 1	Goleta	42		ORCHARD	Avocado			1
20008156	AW0684	Maui	Goleta	31		ORCHARD	Avocado			1
20008153	AW0684	Exxon	Goleta	4		ORCHARD	Avocado			1
20008155	AW0684	Rancho Tres Canadas	Goleta	168		ORCHARD	Avocado			1
20008160	AW0684	Veronica Spring Ranch	Santa Barbara	3.3		ORCHARD	Avocado			1
20008157	AW0684	La Paloma Ranch	Goleta	65	0	ORCHARD	Avocado			1
20000850	AW0686	Brohelle Vineyards	Paso Robles	17	0	VINEYARD				1
20002203	AW0687	windmill ranch	solvang	17	0	VINEYARD	Grapes, Wine			1
20011602	AW0689	sarah's vineyard	gilroy	12	12	VINEYARD				1
20002131	AW0691	Meadowlark Nursery	Hollister, CA	3		NURSERY				1
20003955	AW0693	Duncan Block	San Juan Bautista	25	0	ROW	Onion, Dry	Broccoli	Pepper, Fruiting	1
20003952	AW0693	Seminis Pacific Coast Breeding Station	San Juan Bautista	25	0	ROW	Lettuce, Head	Tomato	Pepper, Fruiting	1
20002662	AW0699	Duncan Ranch	San Juan Bautista	25	0	ROW	Chinese Cabbage	Parsley	Other	1
20002673	AW0699	Gubser Ranch	San Juan Bautista	18	0	ROW	Leek	Beet	Other	1
20002653	AW0699	Flint Ranch	San Juan Bautista	16	0	ROW	Leek			1
20013090	AW0699	Verissimo Ranch	San Juan Bautista	18.5	0	ROW	Lettuce, Leaf			1
20012603	AW0699	Buena Vista Ranch	Hollister	40	0	ORCHARD	Walnut			1
20012602	AW0699	Felice Ranch	San Juan Bautista	45.9	0	ROW	Other			1
20013089	AW0699	Goff Ranch	San Juan Bautista	18	0	ROW	Radish			1
20007189	Aw0702	Seiler Farms	Hollister	35	0	ORCHARD				1
20000737	AW0703	Sanchez Nursery	Hollister	0.75		GREENHOUSE				1
20003040	AW0707	Idyll Times Vineyard	Hollister	10		VINEYARD				1
20004713	AW0717	Buena Vista Ranch	Hollister	26		ORCHARD	Wheat			1
20004716	AW0717	Fairview	Hollister	25		ORCHARD	Bean, Dried			1
20007209	AW0720	Baehner Fournier Vineyards	santa ynez	0	0	VINEYARD				1
20007767	AW0722	HICKEY RANCH LP	CARPINTERIA	35	35	ORCHARD	Avocado			1
20007769	AW0722	WELLS RANCH	CARPINTERIA	8	8	ORCHARD	Avocado			1
20007808	AW0723	Home Ranch	Tres Pinos	18	0	ORCHARD				1
20000802	AW0725	Donati Family Vineyard	Paicines	46		VINEYARD				1
20001002	AW0726	C & P	Hollister	30	0	ORCHARD	Walnut			1
20001005	AW0726	Junction Ranch	Hollister	21	0	ORCHARD	Walnut			1
20001004	AW0726	Dunlap	Hollilster	8	0	ORCHARD	Walnut			1
20004553	AW0727	Lompa Farms	hollister	76	40	ROW	Walnut	Lemon		1
20001585	AW0729	William J Freitas	San Juan Bautista	6	0	ORCHARD	Walnut			1
20004599	AW0730	Speedling, Inc	Watsonville	20	0	NURSERY, GREENHOUSE	Tomato	Celery	Brussel Sprout	1
20008282	AW0742	Ritter Ranch	Hollister	2		VINEYARD				1
20000652	AW0744	Patrick Wirz	Hollister	82	0	VINEYARD, ORCHARD	Pastureland			1
20000789	AW0748	Ranch 2 and Ranch 2B	Hollister	5	0	VINEYARD, ORCHARD	Grape	Walnut		1
20007662	AW0749	Hayato Nursery	Salinas	4	0	NURSERY, GREENHOUSE	Other			1
20000710	AW0756	Johnson	Arroyo Grande	8	0	ORCHARD	Avocado			1
20003140	AW0758	Shrefler Ranch	Arroyo Grande	4.5		ORCHARD				1
20003613	AW0762	CE Farm	Paicines, CA	3	0	ORCHARD				1
20005124	AW0765	Old Bolsa	Gilroy	24	24	ROW	Onion, Dry	Tomato	Pepper, Fruiting	1
20004254	AW0766	Brisson Ranch	Hollister	0	0	ROW	Pastureland			1
20004252	AW0766	Casillas Home Ranch	Hollister	30	0	ROW, ORCHARD	Onion, Dry	Pepper, Fruiting	Pastureland	1
20003275	AW0767	Comstock Ranch	Hollister	5.55	0	ORCHARD	Other			1
20002890	AW0768	Mt. Harlan Vineyard	Hollister	80	0	VINEYARD	Grapes, Wine			1
20004879	AW0772	John Delwiche Ranch	Carpinteria	150	0	ORCHARD	Avocado			1
20008053	AW0776	Domingo Farms	Arroyo Grande	30		ROW	Beet	Spinach	Lettuce, Leaf	1
20001330	AW0777	Hog Canyon vineyard & Orchard	San Miguel	31	0	VINEYARD, ORCHARD				1
20004354	AW0778	Del Prado Cattle Co.	Morro Bay	15	0	ORCHARD				1
20002781	AW0780	Westigard Vineyards	Paso Robles	31		VINEYARD				1
20004811	AW0782	Pretty-Smith Vineyards & Winery	San Miguel	30	0	VINEYARD				1
20007384	AW0783	Calleri Vineyard	Tres Pinos	34	0	VINEYARD				1
20007371	AW0783	Siletto Vineyard	Tres Pinos	30	0	VINEYARD				1
20007377	AW0783	John Smith Vineyard	Hollister	40	0	VINEYARD				1
20007386	AW0783	Skow Vineyard	Tres Pinos	20	0	VINEYARD				1
20007381	AW0783	Wheeler Vineyard	Tres Pinos	35	0	VINEYARD				1
20001516	AW0784	Gimelli Vineyards	Hollister	294.5		VINEYARD				1

20007899	AW0785	haussler organic farms	templeton, CA	3	0	ORCHARD				1
20007927	AW0790	Mesa Pines Ranch	Arroyo Grande	4	0	ORCHARD				1
20008537	AW0794	Zruz-ess Avocado Ranch	morro bay	4.5	0	ROW	Avocado			1
20002676	AW0796	Wats	Watsonville	20		ROW	Other	Other	Other	1
20002681	AW0796	Roberts	Hollister, CA	50		ROW	Other	Other	Other	1
20002682	AW0796	Morris	San Juan Bautista	20		ROW	Other	Other	Other	1
20007447	AW0797	Boynton Ranch	Hollister	1	0	ORCHARD	Walnut			1
20007440	AW0797	Galvin/Delehanty Ranch	Hollister	58	0	ORCHARD	Walnut			1
20007445	AW0797	Pepper Tree Ranch	Hollister	30	0	ORCHARD	Walnut			1
20007442	AW0797	Hawkins/Frates Ranch	Hollister	30	0	ORCHARD	Walnut			1
20001044	AW0800	Sunnyslope Farm	Shandon	136	0	VINEYARD				1
20010763	AW0801	RANCH 6 PLOT 1 MESA RD.	NIPOMO	26	26	ROW	Strawberry			1
20010742	AW0801	ranch 4, plot 1 orchard rd., nipomo	nipomo	40	40	ROW	Strawberry			1
20006442	AW0801	RANCH 5 PLOT 2 GRACE LANE	Nipomo	3	3	ROW	Strawberry			1
20010762	AW0801	RANCH 5 PLOT 1 BETW. GRACE LANE&ORCHARD RD.	NIPOMO	21	21	ROW	Strawberry			1
20010764	AW0801	RANCH 7 PLOT ORCHARD RD.	NIPOMO	16	16	ROW	Strawberry			1
20005268	AW0802	sUNSET rIDGE vINEYARDS	paso robles	5	0	VINEYARD				1
20003068	AW0803	Terry Hoage Vineyards	Paso Robles	16		VINEYARD	Grapes, Wine	Grapes, Wine	Grapes, Wine	1
20004683	AW0805	Beck AG Operations Inc.	Creston	45	0	VINEYARD				1
20002860	AW0808	Vina de Leon	Paso Robles	34	0	VINEYARD				1
20000670	AW0809	Spellacy Farms	morro bay	6	0	ORCHARD				1
20001726	AW0810	EAST TEFFT STREET	NIPOMO	35		ORCHARD	Lemon	Avocado	Orange	1
20004164	AW0811	Fiscalini Ranch	Cambria	30	0	ROW	Peas			1
20004570	AW0813	Sylvester Ranch	San Luis Obispo	7		ROW	Cauliflower			1
20002601	AW0814	Gordon Bennett Family	Arroyo Grande	1.5	0	ORCHARD	Avocado			1
20005360	AW0817	Tonini Farm and Cattle Company	San Luis Obispo	140	0	ROW, ORCHARD	Bean, Unspecified	Peas	Pastureland	1
20000729	AW0819	Shoestring Winery and Vineyard llc	Solvang	35		VINEYARD				1
20003149	AW0820	Bar TJ/Bordonaro Vineyards	Paso Robles	78	0	ROW, VINEYARD	Pastureland			1
20001257	AW0823	Five Oaks Vineyard	Paso Robles	10	0	VINEYARD				1
20005113	AW0825	Phiferanch and Vineyard	Creston	94	0	VINEYARD	Grapes, Wine			1
20007431	AW0826	Harmony Farms	San miguel	38	0	VINEYARD	Grapes, Wine			1
20001266	AW0827	La Familia Ranch	San Luis Obispo	35	0	ROW, ORCHARD	Avocado	Pumpkin		1
20003596	AW0831	Sereno Vista Vineyards	Paso Robles	69.8	0	VINEYARD				1
20003513	AW0834	Frances James Vineyard	Paso Robles	12	12	VINEYARD				1
20004980	AW0835	Dana Powers House	nipomo	5.4	0	ORCHARD	Avocado			1
20004990	AW0835	Dana Powers House 2	nipomo	14	0	ORCHARD	Lemon			1
20001487	AW0837	Heart Stone Vineyard	Paso Robles	7	0	VINEYARD				1
20000985	AW0839	French Camp Vineyards	Santa Margarita	1219.82	1219.82	VINEYARD				1
20002649	AW0841	Alban Vineyards	Arroyo Grande	80		VINEYARD				1
20012522	AW0843	Avocados	Cayucos	10	10	ORCHARD				1
20004780	AW0843	Oranges	Cayucos	8	8	ORCHARD				1
20004781	AW0843	avocado-ken	Cayucos	2	2	ORCHARD				1
20002654	AW0847	Pacar Ranch	Santa Barbara	1.25		ORCHARD				1
20002267	AW0851	Rancho Tierra Rejada	Paso Robles	500		VINEYARD				1
20001441	AW0852	Lehnhoff Farm	Templeton, Ca	35	0	ROW	Oat			1
20001443	AW0854	McClean's Vineyard	Templeton	9	0	VINEYARD				1
20002756	AW0857	Gary Philbrick	Paso Robles	13	0	ORCHARD				1
20000650	AW0858	Kruse Vineyards	Templeton	40	0	VINEYARD				1
20001253	AW0861	Norman Vineyards	Paso Robles	20.1	40	VINEYARD				1
20004710	AW0862	Denner Family, LLC	Paso Robles	109	0	ROW, VINEYARD	Grapes, Wine			1
20007128	AW0864	Elston Family Farm	San Miguel	0.2	0	GREENHOUSE	Tomato	Cucumber		1
20008802	AW0864	Dennis and Gaylo Elston	San Miguel	0.2	0	GREENHOUSE				1
20000751	AW0865	Diamond JEM Vineyard	Paso Raobles	14	0	ROW, VINEYARD	Grapes, Wine			1
20005055	AW0866	Native Sons	Arroyo Grande	8	0	NURSERY		Other		1
20002223	AW0868	St. Peter of Alcantara Vineyards	Templeton	28	0	VINEYARD				1
20001142	AW0869	Larry Kandarian	Los Osos	33	0	ROW	Other	Other		1
20003329	AW0872	pops place farm	cambria	5	0	ORCHARD				1
20001960	AW0876	James Vineyard	Templeton	22	22	VINEYARD				1
20004992	AW0878	Rancho Encino Vineyard	Paso Robles	22	0	VINEYARD	Grape			1
20003411	AW0883	Tate Ranch	Nipomo	17.5		ORCHARD				1
20003223	AW0884	Lion Rock Ranch	Morro Bay	5		ORCHARD	Avocado			1
20007839	AW0887	Arciero Vineyards	Paso Robles	615	0	VINEYARD				1
20007837	AW0887	Arciero Farms	Shandon	186.7	0	VINEYARD, ORCHARD				1

20005143	AW0890	Hawk's Hill Ranch	Paso Robles	18	0	VINEYARD				1
20001381	AW0890	Catapult	Paso Robles	28	0	VINEYARD				1
20001434	AW0890	Hammond/Crossland Vineyard	Paso Robles	110	0	VINEYARD				1
20001445	AW0890	Messina Vineyard	Paso Robles	59	0	VINEYARD, ORCHARD				1
20001348	AW0890	Azcona Properties	Bradley	34	0	VINEYARD				1
20001447	AW0890	Paso de Record	San Miguel	36	0	VINEYARD				1
20001396	AW0890	Cripple Creek Vineyard	Paso Robles	42	0	VINEYARD				1
20001442	AW0890	Law Family Vineyard	Paso Robles	39	0	VINEYARD				1
20001477	AW0890	Wine Horizons Vineyard	Paso Robles	35	0	VINEYARD				1
20001453	AW0890	Plummer	Paso Robles	42	0	VINEYARD				1
20001437	AW0890	Las Collinas Vineyard	Paso Robles	31	0	VINEYARD				1
20002123	AW0890	PWK Farms	Paso Robles	7	0	VINEYARD				1
20002180	AW0890	Torgy's Vineyards	Paso Robles	30	0	VINEYARD				1
20001371	AW0890	Buena Vista Vineyard	Paso Robles	150	0	VINEYARD				1
20001429	AW0890	Hammond Vineyards Lp	Bradley	210	0	VINEYARD				1
20001459	AW0890	Vista Vineyard	San Miguel	257	0	VINEYARD				1
20001461	AW0890	Wellsona Vineyard	Paso Robles	68	0	VINEYARD				1
20001465	AW0890	Woodland Management Vineyard	Paso Robles	15	0	VINEYARD				1
20001450	AW0890	Patricia Diane Vineyard	Paso Robles	125	0	VINEYARD				1
20001464	AW0890	Paderewski Vineyard	Paso Robles	64	0	VINEYARD				1
20001407	AW0890	Crossland Vineyard	Paso Robles	71	0	VINEYARD				1
20002555	AW0892	HALCYON VINEYARDS	TEMPLETON	20	0	VINEYARD				1
20003373	AW0894	Rolling Hills Vineyard	San Miguel	90	0	VINEYARD				1
20003368	AW0894	Swisscollina	San Miguel	63	0	VINEYARD				1
20003376	AW0894	Eureka Ranchos Vineyard - Kopack	Templeton	22	0	VINEYARD				1
20003365	AW0894	Walter Crest Vineyard	Lockwood	38	0	VINEYARD				1
20004622	AW0895	Ted R. Cooper Ranch	Paso Robles	100	10	ROW, VINEYARD	Pastureland			1
20000637	AW0896	Vista Creek Vineyards	Paso Robles	50	0	VINEYARD	Grapes, Wine			1
20004999	AW0897	HOLLAND AMERICA FLOWERS	ARROYO GRANDE	56	0	GREENHOUSE				1
20000673	AW0898	Jeanine's Avocado Farm	morro bay	6.9	0	ORCHARD				1
20007919	AW0899	R.C. Manuel Farms	Morro Bay	19	0	ROW	Pepper, Fruiting	Squash	Bean, Unspecified	1
20007921	AW0899	R.C. Manuel Farms	Cayucos	20	0	ROW	Pepper, Fruiting	Squash	Bean, Unspecified	1
20007916	AW0899	R.C. Manuel Farm	Cayucos	6	0	ROW	Pepper, Fruiting	Squash	Bean, Unspecified	1
20007918	AW0899	R.C. Manuel Farms	Morro Bay	13	0	ROW	Pepper, Fruiting	Squash	Bean, Unspecified	1
20007920	AW0899	R.C. Manuel Farms	Morro Bay	12	0	ROW	Pepper, Fruiting	Squash	Bean, Unspecified	1
20001605	AW0900	J. Bond Vineyard	Paso Robles	3.68	3.68	VINEYARD	Grapes, Wine			1
20004297	AW0901	Bench Vineyard	Paso Robles	10.14		VINEYARD	Grapes, Wine			1
20004294	AW0901	3695 Mill Road	Paso Robles	17.7		VINEYARD	Apple	Grapes, Wine		1
20004300	AW0901	Terrace Vineyard	Paso Robles	65.31		VINEYARD	Grapes, Wine			1
20004234	AW0901	Home Ranch	Paso Robles	139.73	139.73	VINEYARD	Grapes, Wine			1
20001882	AW0902	Cougar Ridge Vineyards	Paso Robles	20	2	VINEYARD				1
20003321	AW0904	Cypress Hollow Ranch	Cayucos	10	0	ORCHARD	Avocado			1
20004014	AW0906	rn estate vineyard and winery	paso robles	3	0	VINEYARD				1
20001362	AW0908	Rodriguez Ranch	Arroyo Grande	12	0	ROW	Pepper, Fruiting	Brussel Sprout	Lettuce, Leaf	1
20001358	AW0908	Chamisal Ranch	San Luis Obispo	15	0	ROW	Pepper, Fruiting	Brussel Sprout	Lettuce, Leaf	1
20001356	AW0908	Corral Ranch	Arroyo Grande	21.19	0	ROW	Pepper, Fruiting	Brussel Sprout	Lettuce, Leaf	1
20001333	AW0908	Rankin Ranch	Arroyo Grande	8.37	0	ROW	Pepper, Fruiting	Lettuce, Leaf	Brussel Sprout	1
20001329	AW0908	Deleon Ranch	Arroyo Grande	22.26	0	ROW	Pepper, Fruiting	Brussel Sprout	Lettuce, Leaf	1
20001339	AW0908	Alisos Ranch	Arroyo Grande	46.7	0	ROW	Lettuce, Leaf	Pepper, Fruiting	Brussel Sprout	1
20001352	AW0908	Sargent Ranch	Arroyo Grande	2.9	0	ROW	Lettuce, Leaf	Pepper, Fruiting	Brussel Sprout	1
20001341	AW0908	Pennington Ranch	Arroyo Grande	41.64	0	ROW	Lettuce, Leaf	Pepper, Fruiting	Brussel Sprout	1
20001338	AW0908	Smith Ranch	Arroyo Grande	17.45	0	ROW	Lettuce, Leaf	Pepper, Fruiting	Brussel Sprout	1
20001326	AW0908	Goulart Ranch	Arroyo Grande	44.97	0	ROW	Pepper, Fruiting	Lettuce, Leaf	Brussel Sprout	1
20001319	AW0908	Donovan Ranch	Arroyo Grande	47.53	0	ROW	Lettuce, Leaf	Pepper, Fruiting	Brussel Sprout	1
20001324	AW0908	Sullivan Ranch	Arroyo Grande	42.72	0	ROW	Pepper, Fruiting	Brussel Sprout	Lettuce, Leaf	1
20001328	AW0908	Machado Ranch	Arroyo Grande	27.25	0	ROW	Pepper, Fruiting	Lettuce, Leaf	Brussel Sprout	1
20005126	AW0909	Gragg Canyon Ranch	San Luis Obispo	35	0	ORCHARD	Avocado			1
20000703	AW0911	FOOTHILL RANCH	NIPOMO	70	0	ORCHARD	Lemon			1
20002121	AW0913	Manuel Reis and Son	Los Osos	33	0	ROW	Pumpkin	Squash		1
20000831	AW0916	Rock Basin Vineyards	Santa Margarita	2	0	VINEYARD				1
20002950	AW0917	Crother Vineyard	Paso Robles	6		VINEYARD				1
20002700	AW0918	Carriage Vineyards	Templeton, CA 93465	33	33	VINEYARD, ORCHARD				1
20003199	AW0919	Graveyard Vineyards	San Miguel	13	13	VINEYARD	Grapes, Wine			1

20002144	AW0920	clay ranch	paso robles	37	37	VINEYARD				1
20000638	AW0921	Live Oak Vineyards	Paso Robles	65	0	VINEYARD				1
20001012	AW0922	Mather Ranch	Morro Bay	13	0	ORCHARD				1
20007372	AW0925	Windrose Farm	Paso Robles	27	0	ROW, NURSERY, ORCHARD	Apple	Leek	Squash	1
20002327	AW0929	LARRY JOHNSON AVACADOS	MORRO BAY	10	0	ORCHARD	Avocado			1
20004361	AW0930	JanKris Vineyard	Templeton	47.26	47.26	VINEYARD	Grapes, Wine			1
20005822	AW0934	Laetitia Vineyard	Arroyo Grande	625		VINEYARD				1
20004755	AW0935	Templeton Hills Vineyard	Templeton	78	0	VINEYARD				1
20002801	AW0936	Windward Vineyard	Paso Robles	15	0	VINEYARD				1
20007196	AW0937	DWS Vineyard	Paso Robles	62.53	0	VINEYARD	Grapes, Wine			1
20007206	AW0937	CIPCO - Lauras Vineyard	Paso Robles	273.08	0	VINEYARD	Grapes, Wine			1
20007202	AW0937	Derbyshire Farms	San Simeon	62.65	0	VINEYARD	Grapes, Wine			1
20008168	AW0938	same	Paso Robles	40	0	VINEYARD				1
20005227	AW0939	CAGLIERO RANCH	PASO ROBLES	200	0	VINEYARD	Oat			1
20001714	AW0944	Sommer Wholesale Nursery	Templeton	4.5	0	NURSERY				1
20003024	AW0946	Klucker's Colina Poca Vineyard	Paso Robles	50.88	0	VINEYARD				1
20002746	AW0947	Roadrunner Farm	Paso Robles	7	0	VINEYARD				1
20002927	AW0949	Chelle Mountain	Paso Robles	14		VINEYARD				1
20007635	AW0950	Dove Pond Vineyards	Templeton	20	0	VINEYARD	Grapes, Wine			1
20009144	AW0952	Mary Flavan/Flav-R-Mor Farm	Morro Bay	22	22	ORCHARD	Avocado			1
20003894	AW0953	Cooper Farms	Nipomo	7	0	ROW	Cauliflower			1
20004945	AW0954	Chabot Vineyard	Los Alamos	10	0	VINEYARD				1
20001280	AW0955	Larry Meek	San Luis Obispo	3.25	0	VINEYARD				1
20003622	AW0956	McGourty Vineyards LLC	Paso Robles	20	20	VINEYARD	Grapes, Wine			1
20004902	AW0957	caparone	paso robles	13	0	VINEYARD				1
20004338	AW0959	Crowther Ranch	Cambria	60	0	ORCHARD	Avocado			1
20000916	AW0960	Sauret Vineyards	Paso Robles	22	0	VINEYARD				1
20003021	AW0964	Luft Vineyard	Templeton	4	0	VINEYARD				1
20007524	AW0965	Nichols Vineyard	San MIguel	72.85	0	VINEYARD				1
20004740	AW0966	Casagrande Vineyards	San Miguel	249	249	VINEYARD				1
20004741	AW0966	Casagrande Vineyards	Paso Robles	40	40	VINEYARD				1
20002202	AW0968	Janes Ranch Vineyards, Inc.	Paso Robles	15	0	VINEYARD				1
20004989	AW0970	Rancho Cielo	Santa Barbara	225	0	ORCHARD	Avocado			1
20004940	AW0971	Ackerman Vineyards-Tower Oaks Vineyard	Paso Robles	38	0	VINEYARD				1
20007543	AW0974	McCall Farm	Cambria, CA	8	0	ORCHARD	Avocado	Citrus		1
20007502	aw0975	Villicana Vineyards	Paso Robles	11.25		VINEYARD				1
20008447	AW0976	Charan Springs Farm	Cambria	0	0	ROW, NURSERY, ORCHARD, GREENHOUSE	Lettuce, Head	Avocado		1
20003618	AW0977	Amarillas Farming Co., Inc.	Arroyo Grande	18	0	ORCHARD				1
20000981	AW0980	Garey Ranch Vineyard	Santa Maria	281	0	VINEYARD				1
20000976	AW0980	Premiere Coastal Vineyard	Sant Maria	459	0	VINEYARD				1
20001006	AW0980	Sierra Madre Farms	Santa Maria	168	0	VINEYARD				1
20000998	AW0980	Sierra Madre Holdings	Santa Maria	170	0	VINEYARD				1
20000990	AW0980	White Hawk Vineyard	Los Alamos	77	0	VINEYARD				1
20008164	AW0981	Chaves Ranch	Atascadero	2	2	ROW	Pastureland			1
20009224	AW0983	john dana	nipomo	40	0	ROW	Lettuce, Leaf			1
20001363	AW0983	180 acres	nipomo	160	0	ROW	Peas			1
20003457	AW0984	ranch 1/ Mahoney	Nipomo	37	37	ROW	Broccoli	Cauliflower	Lettuce, Head	1
20003484	AW0984	ranch 4/ Machado	Nipomo	41	33	ROW	Cauliflower	Lettuce, Head	Celery	1
20002344	AW0986	Que Sera Syrah Vineyard	Paso Robles	5	2	VINEYARD				1
20000635	AW0987	none	arroyo Grande	1.5	0	ORCHARD				1
20009202	AW0988	Saucelito Canyon Vineyard	Arroyo Grande	3	0	VINEYARD				1
20004395	AW0989	E. Lopez Farms	Nipomo	30	0	ROW	Peas	Pepper, Fruiting	Squash	1
20003288	AW0990	Pacific Sun Growers, Inc.	Nipomo	2	0	GREENHOUSE				1
20004915	AW0994	Amaral Vineyards	Paso Robles	10	0	VINEYARD	Grapes, Wine			1
20003136	AW0995	Esther Rigoni Farm	Arroyo Grande	11	0	ROW	Bean, Unspecified	Artichoke	Pepper, Fruiting	1
20000596	AW1000	Kim Jones	Carpinteria	5	0	ORCHARD	Avocado			1
20000595	AW1000	Kim Jones	Carpinteria	5	0	ORCHARD	Avocado			1
20000597	AW1000	Kim Jones	Carpinteria	5	0	ORCHARD	Avocado			1
20001424	AW1001	3050 Foothill Ranch LLC	Carpinteria	20	0	ORCHARD	Avocado	Orange		1
20001402	AW1001	Bailard Avocado LLC	Carpinteria	16	0	ORCHARD	Avocado			1
20001404	AW1001	DR Citrus Co / Dude Ranch	Carpinteria	12	0	ORCHARD	Avocado			1
20001414	AW1001	October Avocados	Carpinteria	8	0	ORCHARD	Avocado			1
20001411	AW1001	Black Opal Ranch LLC	Carpinteria	8	0	ORCHARD	Avocado	Lemon		1

20001419	AW1001	Irish Trust	Carpinteria	4	0	ORCHARD	Avocado			1
20001422	AW1001	JTR Ranch	Carpinteria	9	0	ORCHARD	Lemon			1
20001374	AW1001	Bailard Citrus Co LLC	Carpinteria	48	0	ORCHARD	Avocado			1
20001408	AW1001	Stoney	Carpinteria	8	0	ORCHARD	Avocado			1
20004557	AW1002	Salinas	Salinas	3.5	0	NURSERY, GREENHOUSE				1
20004167	AW1006	Dos Cruces Ranch	Cambria	38	0	VINEYARD, ORCHARD	Avocado			1
20005008	AW1007	Calcareous VIneyard	Paso Robles	17.61	0	VINEYARD	Grape			1
20003710	AW1008	Okui Farms	Grover Beach	30	0	ROW	Strawberry			1
20000878	AW1009	Jail Flat Ranch	Creston	77	0	ROW	Oat	Barley		1
20003274	AW1011	Dixon Ranch Vineyard	San Luis Obispo	2.5	0	VINEYARD				1
20003441	AW1013	Filipe Ranch	Arroyo Grande	32	0	ORCHARD				1
20004927	AW1015	Urquhart Avacodo's	Morro Bay	10		ORCHARD				1
20003486	AW1016	Rancho de Voladores Vineyard, LLC	Paso Robles	30	0	ROW, VINEYARD	Grapes, Wine			1
20001145	AW1017	Dos Pasos Ranch	Cambria	29	0	ROW, ORCHARD	Pumpkin			1
20007281	AW1018	7th Heaven	Cayucos	15	0	ROW, VINEYARD, ORCHARD	Avocado	Raspberry	Grapes, Wine	1
20004983	AW1019	Malcolm Kingsley, Jr.	Cayucos	3	0	ORCHARD	Avocado			1
20000908	AW1021	Pretty Penny Vineyard	Paso Robles	20	0	VINEYARD				1
20000877	AW1024	Dragon Spring Farm	Cambria	19	0	ROW, ORCHARD	Avocado	Orange	Lemon	1
20002406	AW1025	battaglia ranch	paso robles	23.5	23.5	VINEYARD				1
20001018	AW1026	Wilson Ranches Inc./ Cripple Creek Vineyards	Templeton	85		VINEYARD				1
20003286	AW1027	Dunning Vineyards	Paso Robles	12		VINEYARD	Grapes, Wine			1
20000513	AW1028	Double H Avocado Ranch	Morro Bay	6.5	0	ORCHARD	Avocado			1
20000843	AW1029	MLM Farms, Laughing Goose Farm, and Rocking MC Ranch	San Luis Obispo, Ca 93401	13	0	ORCHARD	Citrus	Olive		1
20001340	AW1030	Bien Nacido	Santa Maria	950	0	VINEYARD, ORCHARD				1
20005092	AW1032	Linn's Fruit Bin	Cambria	8	8	ORCHARD, GREENHOUSE	Avocado	Blackberry	Tomato	1
20001003	AW1035	Mike Dusi	Templeton	90		VINEYARD				1
20001000	AW1035	Lago Farms 2	Paso Robles	33		VINEYARD				1
20000996	AW1035	Lago Farms 1	Paso Robles	30		VINEYARD				1
20003146	AW1036	Finley Family Farm	Templeton	2	2	NURSERY				1
20004327	AW1037	Nurses Pistachio Orchard	Paso Robles	6.25	0	ORCHARD	Pistachio			1
20000909	AW1040	B&E Vineyard	Paso Robles, CA	75	0	VINEYARD				1
20000645	AW1042	Star Farms	San Miguel	25	0	ROW	Oat			1
20004125	AW1043	Ranch #10 - Branin	Los Osos	40	20	ROW	Broccoli	Celery	Lettuce, Leaf	1
20003636	AW1044	Paul Madonna	Cayucos	25	0	ORCHARD				1
20007519	AW1046	Fralich Vineyard and Winery	Templeton	16	2	VINEYARD				1
20007132	AW1048	Morro Canyon Ranch	Morro Bay	30	0	ORCHARD	Avocado	Citrus		1
20004707	AW1050	Wixom Ranch	Morro Bay	19.61	0	ORCHARD	Avocado			1
20004794	AW1052	Righetti Ranch	San Luis Obispo	275	0	VINEYARD, ORCHARD	Avocado	Grapes, Wine		1
20001631	AW1053	JD Sazotti Ranch	Templeton	6	0	ROW, VINEYARD	Grapes, Wine	Grapes, Wine	Grapes, Wine	1
20002485	AW1056	Bella Collina	Paso Robles	8	0	VINEYARD, ORCHARD				1
20002757	AW1060	Silver Horse Winery	San Miguel, CA.	41	0	VINEYARD	Grapes, Wine			1
20004427	AW1062	Pipestone Vineyards	Paso Robles	7	7	VINEYARD				1
20003651	AW1063	Victor Cambero	Nipomo	9		ROW	Squash, Summer	Bean, Unspecified	Peas	1
20000936	AW1064	Donald & Elaine Witmer	Paso Robles, CA	14	0	ORCHARD	Pistachio			1
20010342	AW1067	CERVINI FARMS CALIFORNIA INC.	CARPINTERIA	8	0	GREENHOUSE	Cucumber			1
20008023	AW1069	Augusta B. Lord Trust Property	Carpinteria	12.5	0	ORCHARD	Avocado			1
20008024	AW1069	Laura B Lord Ranch	Carpinteria	3	0	ORCHARD	Avocado			1
20003675	AW1070	White Farms	Carpinteria	27		ORCHARD	Avocado			1
20001632	AW1071	The Falcone Family Vineyards	Paso Robles	8	0	VINEYARD	Grapes, Wine			1
20007427	AW1074	Ghost Ranch	Carpinteria	8	0	ORCHARD	Avocado			1
20003898	AW1075	Barnard Ranch	Carpinteria	22	22	ORCHARD				1
20007361	AW1076	Abe Nursery	Carpinteria	6	6	NURSERY				1
20006861	AW1079	Rancho Tres Gatitos	Carpinteria	8	0	ORCHARD				1
20002747	AW1079	Rancho Tres Gatitos Orchards	Carpinteria	8	8	ORCHARD	Other	Avocado		1
20002520	AW1082	Locatelli Vineyards	San Miguel	40	0	VINEYARD				1
20004428	AW1084	Ranch 2	Santa Maria	48	48	ROW	Broccoli			1
20000541	AW1086	Warren's Nursery Inc.- Buckskin	Los Osos	0.6	0	GREENHOUSE	Other	Other	Other	1
20000542	AW1086	Warren's Nursery Inc. - Clark	Los Osos	0.5	0	GREENHOUSE	Other	Other	Other	1
20007168	AW1088	birch-hill organics	atascadero	7	0	ORCHARD	Citrus			1
20004822	AW1089	4M vineyard	San Miguel, CA	9	0	VINEYARD	Grapes, Wine			1
20003892	AW1093	:Thomas Fogarty Vineyard South	Los Gatos	13.2	0	VINEYARD				1
20000872	AW1094	Olive Hill Farm	Santa Ynez	7.5	0	ORCHARD	Olive			1
20002652	AW1095	Elder Vineyard	Creston	12	0	VINEYARD				1

20000678	AW1096	Fair Haven Avocados	morro bay	8.3	0	ORCHARD				1
20001439	AW1097	Vist Grande Vineyard	San Miguel	205	0	VINEYARD				1
20001067	AW1097	Chalk Knoll Vineyard	San Ardo	328	0	VINEYARD				1
20003610	AW1098	pozo valley vineyards	santa margarita	30	0	VINEYARD				1
20005106	AW1102	Morro Creek Ranch LLP	Morro Bay	218	0	ORCHARD	Avocado			1
20002543	AW1103	Keyser Ranch	Morro Bay	5	0	ORCHARD	Avocado			1
20000667	AW1105	Field 2	Arroyo Grande	4		NURSERY	Other			1
20000668	AW1105	Field 1	Arroyo Grande	0.46		NURSERY	Other			1
20000669	AW1105	GB	Arroyo Grande	0.23		NURSERY	Other			1
20000508	AW1106	Lock Vineyard	Paso Robles	23	0	VINEYARD	Grapes, Wine			1
20000804	AW1109	Green Earth Landscape & Nursery	Carpinteria	4	4	NURSERY				1
20000807	AW1109	Green Earth Landscape & Nursery	Carpinteria	0.25	0	NURSERY				1
20002686	AW1110	Tuscali Olive Oil	Templeton	5	0	ORCHARD				1
20000892	AW1111	bassetti vineyards	cambria	19	0	VINEYARD, NURSERY, ORCHARD	Grapes, Wine	Olive		1
20000715	AW1114	Rosenberg Nut Farm, LLC	san miguel	133	160	ORCHARD	Walnut			1
20005112	AW1116	Kiler Canyon Vineyard	Paso Robles	25.5	0	ROW, VINEYARD	Grapes, Wine			1
20001729	AW1118	Stephen's Vineyard	Templton	1.5		VINEYARD				1
20001146	AW1120	August Ridge Vineyards	Creston	9	0	VINEYARD, ORCHARD				1
20007355	AW1123	Negranti Green Valley Ranch	Cambria	74		ORCHARD	Avocado	Lemon	Orange	1
20002923	AW1124	Erwin Farms & Nursery, Inc.	Arroyo Grande	40	0	ORCHARD	Avocado			1
20003304	AW1125	El Pomar Vineyards	Templeton	26	26	VINEYARD				1
20007185	AW1126	Radike Vineyard	Templeton	8.5	0	VINEYARD				1
20001480	AW1129	Eufloria Flowers	Nipomo	8	0	GREENHOUSE				1
20004225	AW1130	Lewis BIDDLE RANCH (701)	SAN LUIS OBISPO	3	3	ROW	Cabbage	Chinese Cabbage	Pepper, Fruiting	1
20004222	AW1130	Sweeney BIDDLE RANCH (801)	SAN LUIS OBISPO	22	22	ROW	Pepper, Fruiting	Brussel Sprout	Chinese Cabbage	1
20004224	AW1130	Maino BIDDLE RANCH (501)	SAN LUIS OBISPO	22	22	ROW	Brussel Sprout	Cabbage	Pepper, Fruiting	1
20004217	AW1130	lewis	sn Luis obispo	70	70	ROW	Brussel Sprout	Chinese Cabbage	Pepper, Fruiting	1
20004221	AW1130	Falstrom BIDDLE RANCH (101)	SAN LUIS OBISPO	24	24	ROW	Cabbage	Chinese Cabbage	Pepper, Fruiting	1
20004223	AW1130	Riley BIDDLE RANCH (401)	SAN LUIS OBISPO	22	22	ROW	Brussel Sprout	Chinese Cabbage	Pepper, Fruiting	1
20004218	AW1130	Lewis Biddle Ranch (901)	san luis Obispo	24	24	ROW	Chinese Cabbage	Brussel Sprout	Pepper, Fruiting	1
20001108	AW1132	French Ranch	Morro Bay	3	0	ORCHARD	Avocado			1
20004262	AW1135	None	Nipomo	6	0	GREENHOUSE				1
20003598	AW1136	Red Wing Ranch	Cambria	14	0	ROW, ORCHARD	Corn, Human Con.			1
20011162	AW1137	San Luis Obispo	San Luis Obispo	35.85	0	ROW	Broccoli	Chinese Cabbage	Celery	1
20011163	AW1137	San Luis Obispo	San Luis Obispo	35.85	0	ROW	Broccoli	Chinese Cabbage	Celery	1
20001126	AW1138	Swift Subtropicals/Bear Creek Ranch	Los Osos	12	0	ROW, ORCHARD	Other	Potato	Squash	1
20002980	AW1139	Apache Canyon Ranch	Maricopa	996	189	ROW	Oat			1
20008435	Aw1141	Salisbury Vineyards	Avila Beach	35	0	VINEYARD				1
20008436	Aw1141	Tia Linda Vineyard	Paso Robles	10	0	VINEYARD				1
20010882	AW1145	Ranch 57	Arroyo Grande	11.74	11.74	ROW	Chinese Cabbage	Lettuce, Leaf	Celery	1
20003278	AW1145	Ranch 27	Arroyo Grande	43	5	ROW, ORCHARD	Avocado	Chinese Cabbage	Lettuce, Leaf	1
20003283	AW1145	Ranch 37	Arroyo Grande	35	35	ROW	Lettuce, Leaf	Cabbage	Pepper, Fruiting	1
20003282	AW1145	Ranch 27	Arroyo Grande	7	7	ROW	Lettuce, Leaf	Cabbage	Pepper, Fruiting	1
20003281	AW1145	Ranch 27	Arroyo Grande	4.5	4.5	ROW	Pepper, Fruiting	Cabbage	Lettuce, Leaf	1
20013203	AW1145	Ranch 67	Arroyo Grande	18	0	ROW	Squash	Lettuce, Leaf	Chinese Cabbage	1
20003205	AW1145	Ranch 47	Arroyo Grande	37	37	ROW	Chinese Cabbage	Lettuce, Head	Parsley	1
20003280	AW1145	Ranch 27	Arroyo Grande	3	3	ROW	Cabbage	Lettuce, Leaf	Chinese Cabbage	1
20003668	AW1147	toro creek ranch	morro bay	50	0	ORCHARD	Avocado	Citrus		1
20001251	AW1149	Cal Seedling co.	arroyo grande	2.5	0	NURSERY, GREENHOUSE				1
20004315	AW1150	Ranch #6 - Lopes	San Luis Obispo	16	0	ROW	Pepper, Fruiting	Squash		1
20004318	AW1150	Ranch #7 - Mitchell	San Luis Obispo	24	0	ROW	Chinese Cabbage	Pepper, Fruiting		1
20004310	AW1150	Ranch #1 Plot 9 - Christensen and Ida Avila	San Luis Obispo	14	0	ROW	Pepper, Fruiting			1
20004311	AW1150	Ranch #2 - Cross Creek	San Luis Obispo	28	0	ROW	Pepper, Fruiting	Squash		1
20004320	AW1150	Ranch # 8 - Walter Christensen	San Luis Obispo	36	0	ROW	Chinese Cabbage	Squash, Summer	Pepper, Fruiting	1
20004337	AW1150	Ranch #16 - Gardner Ranch	San Luis Obispo	95	0	ROW	Peas	Bean, Unspecified	Wheat	1
20003181	AW1151	Vista de la Estrella Vineyards	San Miguel	70	0	VINEYARD	Grapes, Wine			1
20004798	AW1154	North Dana Foothill Ranch	Nipomo	44	0	ORCHARD	Avocado			1
20001217	AW1155	Olson Ranch	Soledad	576.97	0	VINEYARD				1
20001203	AW1155	Brildewood Vineyard	Santa Ynez	36.28	0	VINEYARD				1
20001170	AW1155	Sunnybrook Vineyards	Paso Robles	508	0	VINEYARD				1
20005178	AW1156	Estrella River Vineyard	Paso Robles, CA	251.43	0	ROW, VINEYARD	Blueberry			1
20005173	AW1156	Cross Canyon Vineyard	San Miguel, CA 93451	243	0	VINEYARD				1
20005184	AW1156	Rancho Real	Santa Maria, CA 93455	213	0	VINEYARD				1

Enrollment information in the Water Board's GeoTracker data management system as of Aug. 1, 2012.

20001245	AW1157	Eberle Winery	Paso Robles	38	0	VINEYARD				1
20001243	AW1157	Batdorf Vineyard	Paso Robles	106.5	0	VINEYARD				1
20001238	AW1157	Steinbeck Vineyards	Paso Robles	336.5	0	VINEYARD				1
20001241	AW1157	Mill Road Vineyards	Paso Robles	153	0	VINEYARD				1
20003826	AW1162	Rancho De Los Flores	Los Alamos	375	375	ROW	Other			1
20005302	AW1166	Ellwood Ranch Inc.	Goleta	151.5	151.5	ORCHARD				1
20003545	AW1170	Jardine Vineyard	Paso Robles	279.92		VINEYARD	Grapes, Wine			1
20003549	AW1170	Pleasant Valley Vineyard	San Miguel	64.16		VINEYARD	Grapes, Wine			1
20003550	AW1170	Aline's Vineyard	Paso Robles	157.7	0	VINEYARD	Grapes, Wine			1
20003547	AW1170	Creston Valley Vineyard	Creston	201.32		VINEYARD	Grapes, Wine			1
20003544	AW1170	Huerhuero Vineyard	Paso Robles	523.92		VINEYARD	Grapes, Wine			1
20005186	AW1171	Felice Valle Vineyards	Paso Robles	46	0	VINEYARD				1
20005217	AW1174	Brassica Nursery	Nipomo	4	0	GREENHOUSE				1
20007507	AW1175	VellaVacencia Vineyard	Paso Robles	5	0	ROW, VINEYARD	Grapes, Wine	Apple		1
20003444	AW1177	H&W Farms/Whitefield Lemon Orchard	Nipomo	85		ORCHARD				1
20004807	AW1180	Ron Tremper	Arroyo Grande	40		ORCHARD				1
20009982	AW1181	Krouse (6)	Arroyo Grande	33	10	ROW	Broccoli	Cauliflower	Lettuce, Head	1
20010002	AW1181	Hollywood (66)	Arroyo Grande	23	7	ROW	Broccoli	Cauliflower	Lettuce, Head	1
20009980	AW1181	Manderscheid (5)	Arroyo Grande	40	12	ROW	Broccoli	Cauliflower	Lettuce, Head	1
20010024	AW1181	Taylor Trust (12)	Arroyo Grande	5	2	ROW	Broccoli	Cauliflower	Lettuce, Head	1
20010025	AW1181	Taylor (11)	Arroyo Grande	18	5	ROW	Broccoli	Cauliflower	Lettuce, Head	1
20007488	AW1182	Cirone Farms Morro Bay	Morro Bay	10	0	ORCHARD	Avocado	Citrus		1
20007942	AW1183	Ranch 5	santa maria	19	19	ROW	Broccoli	Celery	Cauliflower	1
20001216	AW1187	Menzies Ranch	Ventucopa	160	0	ROW	Carrot			1
20001219	AW1187	JRM Ranch	New Cuyama	160	0	ROW	Carrot			1
20001222	AW1187	Campbell Ranch	Ventucopa	250	0	ROW	Carrot			1
20000683	AW1193	East Valley Vineyards	Santa Ynez	2		VINEYARD	Grapes, Wine			1
20000881	AW1194	Hill Top Ranch	Lompoc	40	0	VINEYARD				1
20004805	AW1195	Ladera Farms	Santa Barbara	4	0	ORCHARD				1
20000806	AW1199	San Marcos Growers	Santa Barbara	21	21	NURSERY, GREENHOUSE				1
20002646	AW1202	Bernard Acquistapace/Pianta Bella Nursery	Carpinteria	4	0	NURSERY				1
20008303	AW1204	4	Lompoc	32	0	ROW	Lettuce, Head	Bean, Dried		1
20008316	AW1204	22	Lompoc	190	0	ROW	Bean, Dried			1
20008317	AW1204	23	Lompoc	130	0	ROW	Bean, Dried			1
20008302	AW1204	2	Lompoc	25	0	ROW	Bean, Dried			1
20008306	AW1204	9	Lompoc	30	0	ROW	Bean, Dried			1
20008329	AW1204	39	Lompoc	20	0	ROW	Bean, Dried	Cauliflower		1
20008326	AW1204	31	Buellton	30	0	ROW	Bean, Dried			1
20008325	AW1204	30	Buellton	37	0	ROW	Bean, Dried			1
20008308	AW1204	10	Lompoc	20	0	ROW	Bean, Dried			1
20002411	AW1205	2 Peas in a Pod Inc.	Arroyo Grande	2.5	0	ROW, ORCHARD	Blueberry	Raspberry	Blackberry	1
20007657	AW1206	UCSC Farm (CASFS)	Santa Cruz, CA	16	0	ROW, NURSERY, ORCHARD, GREENHOUSE	Apple	Broccoli	Onion, Dry	1
20003801	AW1207	Miramonte Farms & Nursery	San Juan Bautista, CA.	4		ROW	Cauliflower	Broccoli	Lettuce, Leaf	1
20000923	AW1209	Monaco's	Hollister	7	0	ORCHARD				1
20007829	aw1212	B & R Farms	Hollister	93	0	ORCHARD	Other	Other		1
20008882	AW1213	Carroll ranch 2	Hollister	35	0	ORCHARD	Walnut			1
20007828	aw1214	Home Ranch	Hollister	52	0	ORCHARD	Walnut			1
20007830	aw1214	Benevento Orchard	Hollister	29	0	ORCHARD	Walnut	Other		1
20007833	aw1214	Sanchez Ranch	Hollister	8	0	ORCHARD	Other			1
20001570	AW1215	Vista Verde Vineyards	Paicines CA, 95043	607.79	0	VINEYARD				1
20008546	AW1216	fair view	hollister	5	0	ROW	Squash			1
20002460	AW1216	Palm Tag Ranch	Hollister	15	0	ROW	Beet	Squash	Peas	1
20008542	AW1216	Cagney	San Juan Batista	17	0	ROW	Squash	Kale	Leek	1
20003611	AW1217	Kin Fai Chan Nursery	Hollister	7	0	GREENHOUSE				1
20000507	AW1219	DeLay Ranch	Ventura	20	0	ORCHARD	Avocado			1
20004729	AW1223	Ping Huang Cheng Nursery	Gilroy	1		NURSERY				1
20002403	AW1226	parcel # 830-04-044-00 Turturici Ranch	gilroy	2	0	ORCHARD	Apple	Other	Walnut	1
20007491	AW1229	Fukagawa Farm	Gilroy, California	22.69	5	ROW	Corn, Human Con.	Bean, Unspecified	Potato	1
20006625	AW1230	San Ysidro Vineyard	Gilroy	227	0	VINEYARD				1
20002780	AW1232	Lucy Chang Farm	Morgan Hill	15	0	NURSERY, GREENHOUSE				1
20003608	AW1234	Da Xiong Tan Nursery	Morgan Hill	4	0	GREENHOUSE	Cabbage	Chinese Cabbage	Cauliflower	1
20003020	AW1235	t&l flowers	gilroy	3	0	GREENHOUSE				1
20003808	AW1240	Jian Guang Liang Nursery	Gilroy	5	0	GREENHOUSE	Chinese Cabbage	Mustard	Spinach	1

20003574	AW1242	shun heung kwong	gilroy	5		NURSERY, GREENHOUSE	Chinese Cabbage			1
20001725	AW1243	Janong USA	San Martin	5.61	0	GREENHOUSE	Cabbage	Radish	Cucumber	1
20001923	AW1244	Mai Wu Less Nursery	Morgan Hill	2.5	0	ROW, GREENHOUSE	Chinese Cabbage			1
20003606	AW1245	SHING HOU MOK NURSERY	Morgan Hill	5	0	GREENHOUSE	Chinese Cabbage	Kale	Mustard	1
20004213	AW1246	Peter Chak Nursery	San Martin	2	0	GREENHOUSE				1
20001884	AW1253	EL RANCHO TAJIGUAS	goleta	350	350	ORCHARD	Avocado	Avocado	Avocado	1
20003586	AW1255	Rui Kuang Farm	San Martin	6		GREENHOUSE	Chinese Cabbage	Mustard	Spinach	1
20002677	AW1256	Condor Ridge	Goleta	13	0	ORCHARD	Citrus	Avocado	Other	1
20002678	AW1256	Antrim	Goleta	9	0	ORCHARD	Citrus	Avocado	Other	1
20002683	AW1256	Parsons Project	Goleta	4	0	ORCHARD	Citrus	Avocado	Other	1
20002680	AW1256	Justice	Goleta	8	0	ORCHARD	Citrus	Avocado	Other	1
20002230	AW1257	Lau's Nursery	San Martin	3	0	GREENHOUSE				1
20004016	AW1258	Joe Chen Nursery	Gilroy	1	1	GREENHOUSE				1
20004059	AW1259	stargate ranch llc	goleta	106	106	ORCHARD	Avocado	Lemon		1
20007605	AW1260	Yoi Foo Chun	San Martin	3	3	GREENHOUSE	Chinese Cabbage			1
20007391	AW1269	WY Chan Nursery	Gilroy	1	0	NURSERY, GREENHOUSE				1
20003784	AW1273	An Yang Chen Nursery	Morgan Hill	4		GREENHOUSE	Chinese Cabbage			1
20003565	AW1274	Kwong Nursery	Gilroy	5	0	NURSERY				1
20002240	AW1276	Mannstand Vineyard	Gilroy	15	0	VINEYARD	Grapes, Wine			1
20003723	AW1278	HUANG MEI HUAN	San Martin	3	0	GREENHOUSE	Chinese Cabbage	Celery	Cauliflower	1
20001921	AW1280	Bailey Farm	Gilroy	1	0	VINEYARD	Grapes, Wine			1
20007802	AW1282	Vanumanutagi Vineyard	Gilroy	13	200	VINEYARD				1
20007801	AW1282	Redwood Retreat Ranch	Gilroy	7	99	VINEYARD				1
20007844	AW1283	Liang's Nursery	gilroy	13		GREENHOUSE				1
20002094	AW1284	PAJARO GREENHOUSES	WATSONVILLE	8		GREENHOUSE				1
20002086	AW1284	KITAYAMA GREENHOUSE	WATSONVILLE	6		GREENHOUSE				1
20002084	AW1284	SWANTON PACIFIC RANCH	DAVENPORT	65		ROW	Other			1
20002083	AW1284	WILDER RANCH	SANTA CRUZ	120	0	ROW	Other			1
20002093	AW1284	FREEDOM GREENHOUSES	FREEDOM	7.5	0	GREENHOUSE				1
20009684	AW1285	Argyle Vineyard	King City	30	0	VINEYARD	Grapes, Wine			1
20007558	AW1288	Ernesto Wickenden Vineyard	Santa Maria	3	0	VINEYARD				1
20007559	AW1288	Tinaquaic Vineyard	Santa Maria	10	0	VINEYARD				1
20007556	AW1288	Williamson/Dore Vineyard	Santa Ynez	6.5	0	VINEYARD				1
20005179	AW1289	Ranch 5	Santa Maria	20	20	ROW	Broccoli	Barley		1
20005181	AW1289	Ranch 6	Santa Maria	30	30	ROW	Broccoli	Lettuce, Head	Barley	1
20005683	AW1292	Nuevo Rancho	Lompoc	36	0	VINEYARD				1
20003682	AW1296	Baldwin Ranch	Arroyo Grande	0.5		ORCHARD				1
20007223	AW1297	Santa Rita Hills Appelations Property LLC	lompoc	40	0	ROW	Bean, Unspecified			1
20007222	AW1297	TJ Hayes Ranch Incorporated	lompoc	70	0	ROW	Bean, Unspecified			1
20007224	AW1297	Robert Guerra	lompoc	90	0	ROW	Bean, Unspecified			1
20004019	AW1300	Dwight G. Vedder Co., dba. Vedder Ranch	Carpinteria	100	100	ROW	Avocado	Lemon	Citrus	1
20001518	AW1305	Greenhaven Orchard	Solvang	1.8		ORCHARD				1
20011402	AW1311	Twin Bridges	Gilroy	5	5	NURSERY				1
20011382	AW1311	Old Bolsa Rd	Gilroy	15	15	ROW	Other			1
20001927	AW1312	Solis winery, Inc	Gilroy	10	0	VINEYARD				1
20001932	AW1313	Fratelli ranch, LLC.	Gilroy	10	0	VINEYARD	Grapes, Wine			1
20001332	AW1316	VMA Ranch	Morgan Hill	14	0	ORCHARD				1
20001350	AW1316	Scott Farm	Morgan Hill	1	0	ORCHARD				1
20001359	AW1316	Bunyard Orchard	Morgan Hill	2.75	0	ORCHARD				1
20001367	AW1316	Wickson Orchard	Morgan Hill	1.25	0	ORCHARD				1
20001325	AW1316	Andy's Orchard	Morgan Hill	27.5	27.5	ORCHARD				1
20001361	AW1316	Hedrick Orchard	Morgan Hill	7	0	ORCHARD				1
20001346	AW1316	Nishikawa Ranch	Morgan Hill	2.25	0	ORCHARD				1
20001351	AW1316	Ludwick Ranch	Morgan Hill	1.75	0	ORCHARD				1
20003595	AW1321	Kirigin Cellars	Gilroy	41	0	VINEYARD	Other			1
20004490	AW1324	KAJIKO NUSERY,INC	Morgan Hill,CA 95037	38	0	ROW, GREENHOUSE	Other			1
20005860	AW1325	QUAN ZHONG ZHANG	GILROY	5	0	GREENHOUSE	Chinese Cabbage	Cauliflower	Celery	1
20008036	AW1326	Gilman Ranch	Gilroy	82	82	ROW	Tomato			1
20008029	AW1326	Bloomfield Ranch	Gilroy	190	190	ROW	Tomato			1
20008041	AW1326	Monterey Ranch	Gilroy	20	20	ROW	Tomato			1
20005323	AW1327	Hecker Pass	Gilroy	0	0	ROW	Wheat			1
20005342	AW1327	Masoni Ranch #2	Gilroy	15	0	ROW	Pepper, Fruiting			1
20005338	AW1327	Milias	Gilroy	27	0	ROW	Bean, Unspecified			1

20005326	AW1327	Home Ranch	Gilroy	63	0	ROW	Pepper, Fruiting			1
20005344	AW1327	Mesa Rd North	Gilroy	46	0	ROW	Pepper, Fruiting			1
20005339	AW1327	James Ranch	Gilroy	49	0	ROW	Pepper, Fruiting	Other	Other	1
20005340	AW1327	Masoni Ranch #1	Gilroy	39	0	ROW	Pepper, Fruiting			1
20004631	AW1330	Site 1	Gilroy	60	0	NURSERY				1
20007791	AW1331	xu hong huang	gilroy	3		GREENHOUSE	Chinese Cabbage	Mustard	Cabbage	1
20002581	AW1333	Mellow's Nursery and Farms	Morgan Hill	5	0	NURSERY, ORCHARD, GREENHOUSE	Pepper, Fruiting	Peach	Tomato	1
20002260	AW1337	A & M Farm	Morgan Hill CA 95037	8	0	ROW, GREENHOUSE	Chinese Cabbage	Broccoli	Spinach	1
20003525	AW1339	Emilio Guglielmo Winery Inc	Morgan Hill	45	0	VINEYARD				1
20007739	AW1340	Gera Harding	San Martin	15	0	ROW	Corn, Human Con.	Bean, Dried	Pepper, Fruiting	1
20007749	AW1340	DiNapoli	San Martin	16	0	ROW	Pepper, Fruiting	Bean, Dried	Tomato	1
20007743	AW1340	Llagas Ranch	san martin	46	0	ROW	Bean, Dried	Pepper, Fruiting	Corn, Human Con.	1
20007744	AW1340	Fitzgerlad &Santa Teresa behind Fruitstand	San Martin	15	0	ROW	Tomato	Corn, Human Con.	Pepper, Fruiting	1
20007729	AW1340	Younger	Gilroy	15	0	ROW	Bean, Dried	Cucumber	Corn, Human Con.	1
20007726	AW1340	Robba Ranch	San Martin	40	0	ROW	Cucumber			1
20007734	AW1340	LaBarbera Ranch	San Martin	6	0	ROW	Bean, Dried	Corn, Human Con.	Cucumber	1
20007727	AW1340	Gera Rucker	Gilroy	30	0	ROW	Bean, Dried	Corn, Human Con.	Pumpkin	1
20007724	AW1340	Martin Ranch	San Martin	30	0	ROW	Pepper, Fruiting	Corn, Human Con.		1
20007723	AW1340	Milar Ranch	San Martin	25	0	ROW	Corn, Human Con.			1
20007742	AW1340	San Martin & Colony	San Martin	20	0	ROW	Bean, Dried	Broccoli	Corn, Human Con.	1
20007164	AW1342	South Pacific Orchids, Inc	Gilroy	3	6.5	GREENHOUSE				1
20007162	AW1342	South Pacific Orchids, Inc	Gilroy	2.5	7.5	GREENHOUSE				1
20004566	AW1344	J and P Farm	Morgan HIll	30	0	ROW, ORCHARD	Pepper, Fruiting	Bean, Unspecified	Walnut	1
20002961	AW1350	GLUHAICH RANCH	Gilroy	59	0	ROW	Strawberry	Chinese Cabbage		1
20002962	AW1350	NO. 101 RANCH	Gilroy	46	0	ROW	Corn, Human Con.			1
20002948	AW1350	OLD STORE	Gilroy	29	0	ROW	Chinese Cabbage			1
20002940	AW1350	UESUGI RANCH	Gilroy	18	0	ROW	Corn, Human Con.			1
20002879	AW1350	BOGLE RANCH	Gilroy	29	0	ROW	Corn, Human Con.	Pepper, Fruiting		1
20002951	AW1350	PERRY RANCH	San Martin	12	0	ROW	Chinese Cabbage			1
20011083	AW1350	Luchessa Ave - Filice	Gilroy	51		ROW	Corn, Human Con.			1
20011082	AW1350	Marns Ranch	San Martin	45		ROW	Pepper, Fruiting	Pumpkin		1
20011067	AW1350	Nguyen - Las Animas Ranch	Gilroy	19		ROW	Pumpkin			1
20011065	AW1350	No. 101 - Blks 6A - 6E	Gilroy	28		ROW	Corn, Human Con.			1
20011062	AW1350	Olive Ranch	Morgan Hill	15.4		ROW	Corn, Human Con.	Pepper, Fruiting		1
20011063	AW1350	No. 101 - Blocks 1A & 1B	Gilroy	40		ROW	Chinese Cabbage			1
20003100	AW1351	Yutaka Fujita	Morgan Hill	5	0	ORCHARD	Other			1
20004564	AW1352	Carman's Nursery	Gilroy	1	1	NURSERY, GREENHOUSE				1
20012664	AW1353	Castroville	Castroville	12.5	0	GREENHOUSE	Cauliflower	Brussel Sprout	Celery	1
20001485	AW1353	Headstart Nursery	Gilroy	18	0	NURSERY	Cauliflower	Artichoke	Lettuce, Leaf	1
20008430	AW1357	BONITA RANCH	NIPOMO	40	40	ROW	Strawberry			1
20007105	AW1358	RAK Farm LLC	Solvang	18	18	ORCHARD	Walnut			1
20007122	AW1362	Myriad Flowers	Carpinteria	0	0	GREENHOUSE				1
20005207	AW1364	Rancho Encantado/Shea	Santa Ynez	65	0	ORCHARD	Walnut			1
20005205	AW1364	Rancho Encantado/Stangeland	Santa Ynez	60	0	ORCHARD	Walnut			1
20008169	aw1365	Aguajitos Ranch	goleta	38	38	ORCHARD	Avocado			1
20002134	AW1367	Mosby Winery	Buellton	22	0	VINEYARD				1
20002135	AW1367	Mosby Vineyad	Buellton	17	0	VINEYARD				1
20004928	AW1373	Castro Valley RD	GILROY CA	92		ORCHARD				1
20004939	AW1373	BOLSA RD	GILROY	20		ROW	Bean, Unspecified			1
20009184	AW1373	Godfrey Ranch	Gilroy CA	7		ORCHARD				1
20004922	AW1373	BORELLO FARMS	MORGAN HILL CA 95037	50		ORCHARD				1
20001452	AW1375	9 AC	Gilroy	0	0	ROW	Other			1
20001602	AW1378	Gilroy Ground Cover Nursery	Gilroy	0	0	GREENHOUSE				1
20007409	AW1379	Besson Vineyards Ranch 2	Gilroy	20	0	VINEYARD				1
20007408	AW1379	Besson Vineyards Ranch 1	Gilroy, CA	9	0	VINEYARD				1
20008509	AW1380	Bella Vista	carpinteria	3	0	ROW	Blueberry			1
20007140	AW1385	Varga Ranch	Goleta	14	0	ROW, ORCHARD	Avocado			1
20000516	AW1386	Cottonwood Canyon Vineyard	Santa Maria	56	0	ROW, VINEYARD	Grapes, Wine			1
20003121	AW1388	Hollandia Produce, LLC	Carpinteria	27	9	ORCHARD, GREENHOUSE	Avocado	Other	Lettuce, Head	1
20004126	AW1389	SMBF Battles	Santa Maria	40	40	ROW	Strawberry	Broccoli	Celery	1
20004122	AW1389	Battles	Santa Maria	30	30	ROW	Strawberry	Broccoli	Celery	1
20001370	AW1390	Home ranch and greenhouses	Guadalupe	17	17	ROW, GREENHOUSE	Other			1
20004239	AW1393	La Patera Rancho	Goleta	270	0	ORCHARD	Avocado	Lemon		1

20000941	AW1394	PECK/FLYNN RANCH	CARPINTERIA	46.64	46.64	ROW	Blueberry			1
20000734	AW1394	OTA RANCH	CARPINTERIA	18.14	18.14	ROW	Blueberry			1
20000791	AW1394	PARSONS RANCHES (Includes: Airport' Creek; Hill & Middle)	CARPINTERIA	30.01	30.01	ROW	Blueberry			1
20007754	AW1395	Bermuda Hills Ranch	Santa Barbara	17	0	ORCHARD	Avocado			1
20007183	AW1396	peter miller	santa barbara	35	35	ORCHARD	Avocado			1
20003048	AW1399	Hinnrichs vineyards	Solvang	4	0	VINEYARD	Grapes, Wine			1
20007422	AW1400	mormann vineyard	Lompoc	13	0	VINEYARD	Grapes, Wine			1
20001087	AW1407	Dusi Vineyards	Paso Robles	40		VINEYARD				1
20004009	AW1410	Mar Vista	Nipomo	5	5	VINEYARD, ORCHARD				1
20009643	AW1411	LoBue Orchards	Hollister	12		ORCHARD				1
20009644	AW1411	LoBue Orchards	Hollister	11		ORCHARD				1
20007510	AW1412	Orchard Rd	Hollister	27	0	ORCHARD				1
20007253	AW1413	Ranchita Oaks	San Miguel,Ca	5	0	VINEYARD	Grape			1
20007923	AW1413	Le Vigne Winery & Vineyards	Paso Robles,CA	25		VINEYARD				1
20007264	AW1413	Evenson Vineyards	Paso Robles,CA	11		VINEYARD	Grape			1
20007263	AW1413	Filippini Farmes	Paso Robles,CA	38		VINEYARD	Grape	Olive		1
20007257	AW1413	Bankston Vineyards	Paso Robles,CA	8	0	VINEYARD	Grape			1
20007259	AW1413	Hogue Vigneyards	Paso Robles,CA	9	0	VINEYARD	Grape			1
20007256	AW1413	Zoo to you	Paso Robles,CA	18		VINEYARD	Grape			1
20007261	AW1413	Estrella River Vineyards	San Miguel,Ca	30		VINEYARD	Grape			1
20008622	AW1414	Rancho San Fernando Rey	Santa Barbara	42	0	VINEYARD				1
20003828	AW1416	Rosendale Nursery	Watsonville	2.5	0	NURSERY				1
20003781	AW1418	Drummy Ranch	Goleta	8	0	ORCHARD	Avocado			1
20001230	AW1419	Los Alamos Ranch	Los Alamos	580	55	VINEYARD				1
20002232	AW1420	Dal Pozzo Ranch	Carpinteria	40		ORCHARD				1
20007644	AW1423	Ranch 9	LOMPOC	20.4	20.4	ROW	Lettuce, Head	Broccoli	Artichoke	1
20007642	AW1423	Ranch 8 - Henning	LOMPOC	24	24	ROW	Artichoke	Broccoli	Lettuce, Head	1
20003287	AW1428	Saveria Vineyard	Aptos	12	0	VINEYARD				1
20005122	AW1430	HEATHER POINT/CARTWRIGHT	LA SELVA BEACH	10	10	ROW	Other			1
20005133	AW1430	HEATHER POINT/HEATHERHILL,LLC	LA SELVA BEACH	15	15	ROW	Other			1
20005177	AW1430	BUENA VISTA/CNLLC	WATSONVILLE	11	11	NURSERY, GREENHOUSE	Other			1
20005194	AW1430	RANCHO ROAD RANCH	WATSONVILLE	15	15	ROW, NURSERY	Other			1
20005164	AW1430	SEAVIEW RANCH	WATSONVILLE	30.5	30.5	ROW, NURSERY, GREENHOUSE	Other			1
20005190	AW1430	BUENA VISTA/KAJIHARA	WATSONVILLE	8	8	ROW, NURSERY	Other			1
20005198	AW1430	ELKHORN ROAD RANCH	CASTROVILLE	4	4	GREENHOUSE	Other			1
20005139	AW1430	CREST DRIVE RANCH	WATSONVILLE	9	9	ROW, NURSERY, GREENHOUSE	Other			1
20005107	AW1430	HEATHER POINT/MCAFEE	LA SELVA BEACH	10	10	ROW	Other			1
20005204	AW1430	HEATHER POINT/NESTLINLLC	LA SELVA BEACH	2	2	ROW	Other			1
20008383	AW1432	Lupe	Watsonville	18	18	ROW	Strawberry			1
20005149	AW1433	Frumveller	Hollister	17	0	ROW	Lettuce, Leaf			1
20005105	AW1433	Minto	Watsonville	50	0	ORCHARD				1
20001623	AW1434	PSI Green Valley Ranch	Watsonville	15	4	ROW, GREENHOUSE	Strawberry	Raspberry	Blackberry	1
20005221	AW1435	martinelli	davenport	34	0	ROW	Brussel Sprout	Pumpkin	Artichoke	1
20005219	AW1435	dump ranch	santa cruz	17	0	ROW	Brussel Sprout	Pumpkin		1
20005222	AW1435	seaside	davenport	65	0	ROW	Brussel Sprout	Artichoke	Pumpkin	1
20012823	AW1437	Conlan Ranch	Castroville	46	46	ROW	Strawberry			1
20012822	AW1437	George Ranch	Watsonville	13	13	ROW, GREENHOUSE	Blackberry			1
20012782	AW1437	Peaceful Valley Ranch	Watsonville	14	14	ROW	Strawberry			1
20002328	AW1438	Terra Sole Nurseries, LLC	Watsonville	1	2	NURSERY, GREENHOUSE				1
20003584	AW1439	Deja View Farm & Vineyard	Corralitos	1	1	ROW, VINEYARD, ORCHARD, GREENHOUSE	Beet	Carrot	Squash	1
20001456	AW1440	Vernon E. Marian A. Varni	watsonville	39	0	ORCHARD	Apple			1
20007463	AW1447	Hoey Vineyard	Paso Robles	9	0	VINEYARD				1
20001054	AW1456	Sea Crest Nursery	Santa Barbara	10	0	NURSERY				1
20007765	AW1457	Nelson C Pinkham Ranch	Carpinteria	30		ORCHARD				1
20001122	AW1458	mcroberts farm	goleta	6	0	ORCHARD	Avocado			1
20001640	AW1459	Alondra De Los Prados	Santa Ynez	1		VINEYARD				1
20003139	AW1461	K. M. Nursery, Inc.	Carpinteria	5	0	NURSERY				1
20007588	AW1462	Cuatro Vientos Vineyard	Los Olivos	4	0	VINEYARD				1
20007169	AW1463	Lafond Vineyards Burning Creek	Buellton CA 93427	37	0	VINEYARD				1
20005117	AW1465	Bronson ranch	Watsonville,Ca.	38	38	ROW	Raspberry			1
20005099	AW1465	St.Calir Ranch	Watsonville,California	38	38	ROW	Raspberry			1
20005134	AW1465	MBA /Bunker Hill	Watsonville	46	46	ROW	Strawberry			1
20005125	AW1465	Teaspoon Ranch	Watsonville	39	39	ROW	Raspberry			1

20003591	AW1470	Kwong Nursery	Gilroy	3		GREENHOUSE	Chinese Cabbage	Mustard		1
20001519	AW1471	Chequera Vineyards	Paso Robles	18	0	VINEYARD				1
20005846	AW1472	Buena Vista Ranch	watsonville	13	0	ROW	Strawberry			1
20003330	AW1473	Biagini Vineyards	Aptos	12	0	VINEYARD				1
20003783	AW1477	Albright	Watsonville, CA	48	48	ROW	Lettuce, Leaf			1
20000585	AW1480	Pelio	Carmel Valley	15	0	VINEYARD				1
20000993	AW1483	Minami Greenhouse Inc	Salinas	5	0	GREENHOUSE				1
20004410	AW1486	ALISAL ORGANIC	SALINAS	47	0	ROW	Strawberry			1
20004409	AW1486	ALBA ORGANIC	SALINAS	19		ROW	Strawberry			1
20008409	AW1487	La Reina	Gonzales	61		VINEYARD				1
20008432	AW1487	River Road	Gonzales	215		VINEYARD				1
20005211	AW1489	Peckam Ranch	Watsonville	30	30	ROW	Raspberry			1
20005213	AW1489	Pavlovich Ranch	Watsonville	15	15	ROW	Raspberry			1
20005212	AW1489	Griffith Ranch	Watsonville	48	48	ROW	Blackberry			1
20005209	AW1489	Sherrod	Watsonville	18	10	ROW	Raspberry			1
20005110	AW1489	Home Ranch	Watsonville	58	58	ROW	Raspberry			1
20005210	AW1489	Carlton Ranch	Watsonville	35	35	ROW	Raspberry			1
20004450	AW1507	Peckham Rd Ranch	Watsonville	32	30	ROW	Strawberry			1
20003878	AW1509	Fujii Ranch	watsonville	20	0	ROW	Strawberry			1
20003871	AW1509	Koa Ranch	watsonville	24	24	ROW	Strawberry			1
20007925	AW1510		Watsonville			NURSERY				1
20003838	AW1510	Cavanaugh Color Nursery	Watsonville, Ca 95076	4	0	NURSERY				1
20002461	AW1511	Regan Vineyards	Watsonville	37	0	VINEYARD				1
20007571	AW1514	Shasta Ranch	Watsonville	47	0	ROW	Raspberry			1
20004867	AW1514	Garroutte Ranch	Watsonville	10	3	ROW	Blackberry			1
20004875	AW1514	Cooley Ranch	Watsonville	36	0	ROW	Blackberry	Raspberry		1
20004859	AW1514	Freedom Ranch	Freedom	8	0	ROW	Blackberry			1
20004865	AW1514	Wagner Ranch	Watsonville	20	0	ROW	Blackberry			1
20004853	AW1514	Corralitos Ranch	Corralitos	20	0	ROW	Blackberry			1
20007714	AW1515	Young Vineyard	Santa Ynez 93460	18	0	ROW, VINEYARD	Lettuce, Head	Squash	Bean, Unspecified	1
20001223	AW1518	Ranch 5	Santa Maria	33	33	ROW	Broccoli	Cauliflower	Lettuce, Head	1
20001742	AW1520	County Of Santa Barbara	Goleta	470	0	ORCHARD	Avocado	Other		1
20007124	aw1521	Nishimura 3	Carpinteria	1		ORCHARD	Avocado			1
20011983	AW1523	Betteravia Investments - Harris Ranch (32 Vineyard)	Santa Maria	32	0	VINEYARD				1
20009923	AW1523	Okui (42)	Santa Maria	50	15	ROW	Broccoli	Cauliflower	Lettuce, Head	1
20009975	AW1523	Koyama (75)	Santa Maria	45	14	ROW	Broccoli	Cauliflower	Lettuce, Head	1
20001924	AW1525	Oak Valley Vineyard	Paso Robles	1		ROW, VINEYARD	Grapes, Wine			1
20007725	AW1525	Oak Valley Vineyard	Paso Robles	1	0	VINEYARD				1
20001151	AW1529	Pleasant Valley Vineyard	Aptos	2	0	VINEYARD				1
20001041	AW1532	Molino Creek Farm	Davenport	2	0	ROW	Peas	Squash, Summer	Other	1
20002569	AW1533	Nugent Ranch	Watsonville	96	96	ROW	Raspberry	Blackberry		1
20002570	AW1533	Tynan Ranch	Watsonville	38	38	ROW	Strawberry			1
20004341	AW1534	Siri Ranch	Watsonville	25	0	ROW	Strawberry			1
20004350	AW1534	Office Ranch	Watsonville	30	0	ROW	Strawberry			1
20004761	AW1536	Fraser Ranch	Watsonville	9	0	ORCHARD	Apple			1
20004759	AW1536	Home Ranch	Watsonville	21	0	ORCHARD	Apple			1
20004766	AW1536	Nagamine Ranch	Watsonville	6	0	ORCHARD	Apple			1
20003840	AW1537	Smith Gardens	Watsonville	15	15	NURSERY, GREENHOUSE				1
20004775	AW1539	Knego Ranch	Watsonville	33	0	ROW	Blackberry	Blueberry		1
20001539	AW1540	Andersen Vineyards	Felton	5	0	ROW, VINEYARD	Grapes, Wine	Grapes, Wine	Grapes, Wine	1
20003914	AW1543	Buena Vista Ranch	watsonville	42	30	ROW	Strawberry			1
20007649	AW1546	Hunter Hill	Soquel	5.5	5.5	VINEYARD				1
20004900	AW1547	Braycovich Site 4A	Watsonville	30.47	0	ROW	Raspberry			1
20004920	AW1547	Tsukiji Site 8A	Watsonville	45.13	0	ROW	Raspberry			1
20004889	AW1547	Holohan Site 1A	Watsonville	24.5	0	ROW	Blackberry			1
20004941	AW1547	Pista Site 12A	Watsonville	10.75	0	ROW	Blackberry			1
20004896	AW1547	Jerenich Site 7A	Watsonville	23.23	0	ROW	Blackberry			1
20002262	AW1548	Rancho Del Ciervo	Santa Barbara	470	0	ORCHARD	Avocado	Citrus		1
20001322	AW1548	University Exchange Corporation	Goleta	460.6	0	ORCHARD	Lemon	Avocado		1
20010303	AW1548	County of Santa Barbara / Rancho El Baron	Goleta	107	0	ORCHARD	Avocado	Avocado		1
20010302	AW1548	County of Santa Barbara / Rancho El Baron	Goleta							1
20004910	AW1550	Colendich Ranch	Watsonville	14	0	ROW	Strawberry	Raspberry		1
20003901	AW1551	JEFFERSON RANCH	MARINA	36	0	NURSERY				1

20000607	AW1553	Lelande Ranch	Ventura	31	0	ORCHARD	Avocado				1
20006482	AW1555	Perez Farms	watsonville	4	0	ROW	Bean, Unspecified	Tomato	Other		1
20003336	AW1556	Bassor	Watsonville	33	0	ROW	Raspberry				1
20003342	AW1556	Cassin	Watsonville	26.4	0	ROW	Blackberry	Raspberry			1
20003455	AW1556	Stolich	Watsonville	20	0	ROW	Raspberry				1
20003417	AW1556	Loveless	Watsonville	52.9	0	ROW	Raspberry				1
20003416	AW1556	Loveland	Watsonville	9.7	0	ROW	Blackberry				1
20003349	AW1556	Crossetti	Watsonville	109.9	0	ROW	Blackberry	Raspberry			1
20003356	AW1556	Freedom	Watsonville	40	0	ROW	Raspberry				1
20003447	AW1556	Murphy	Watsonville	26.1	0	ROW	Raspberry				1
20003445	AW1556	Mc Grath	Watsonville	31	0	ROW	Blueberry				1
20003335	AW1556	Banovac	Watsonville CA	14.3	0	ROW	Raspberry				1
20003483	AW1556	Tynan	Watsonville	41	0	ROW	Raspberry				1
20003456	AW1556	Riverside	Watsonville	11	0	ROW	Raspberry				1
20003458	AW1556	R and T Ranch	Watsonville	40	0	ROW	Raspberry				1
20003414	AW1556	Kitayama	Watsonville	46	0	ROW	Strawberry				1
20003485	AW1556	Kalich Ranch	Watsonville	43.3	0	ROW	Mustard				1
20003482	AW1556	Thompson	Watsonville	13.9	0	ROW	Strawberry			DIAZINON	1
20003471	AW1556	Sambrailo	Watsonville	32	0	ROW	Raspberry				1
20003477	AW1556	Shikuma	Watsonville	23	0	ROW	Raspberry				1
20003343	AW1556	Cassin Orchard	Watsonville	35	0	ROW	Raspberry				1
20003452	AW1556	Pavlovich	Watsonville	28.1	0	ROW	Raspberry				1
20003345	AW1556	Coward	Watsonville	50	0	ROW	Raspberry				1
20003340	AW1556	Butier	Watsonville	32.31	0	ROW	Raspberry				1
20003422	AW1556	Marinovich	Watsonville CA	32	0	ROW	Raspberry				1
20003429	AW1556	Mc Grath	Watsonville	30	0	ROW	Raspberry				1
20001503	AW1557	Rincon Del Mar Ranch	Carpinteria	154	10	ROW, ORCHARD	Other				1
20001501	AW1557	Valley View Orchard, Inc.	Carpinteria	5.5		ORCHARD					1
20001695	AW1558	Site 1 (6337)	Carpinteria	11	0	ROW, ORCHARD, GREENHOUSE	Avocado				1
20001698	AW1558	Site 2 (4494)	Carpinteria	2	0	ROW	Avocado				1
20001355	AW1559	Dierberg Drum Canyon Vineyard	Lompoc	60	0	VINEYARD					1
20001357	AW1559	Star Lane Vineyard	Santa Ynez	205.2	0	VINEYARD					1
20001349	AW1559	Dierberg Santa Maria	Santa maria	161.22	0	VINEYARD					1
20010424	AW1560	Enos Ranch 2	Santa Maria	6	3	ROW	Broccoli	Cauliflower	Spinach		1
20010423	AW1560	Santa Maria Cemetary Ranch 2	Santa Maria	17.73	8.8	ROW	Broccoli	Cauliflower	Spinach		1
20007500	AW1561	reliz ranch 5	greenfield	30	0	VINEYARD					1
20004932	AW1562	1850 Stallion Vineyard	Santa Ynez	15	0	VINEYARD					1
20003157	AW1563	Rancho Santa Rosa	Lompoc	230	0	VINEYARD					1
20003527	AW1564	Le Bon Climat	santa Maria	55	0	VINEYARD					1
20003531	AW1564	La Cuna	Los Alamos	10	0	VINEYARD, ORCHARD					1
20001337	AW1566	Mesa Verde Vineyards ,LLC	Santa Ynez	34	0	VINEYARD					1
20000435	AW1567	Longshot Minx Vineyards	Paso Robles	14	0	VINEYARD					1
20004572	AW1570	MONTEREY BAY NURSERY, INC.	ROYAL OAKS	30	0	NURSERY					1
20002820	AW1571	HOME RANCH #1	GONZALES	38.4	0	ROW	Broccoli	Lettuce, Leaf	Cauliflower		1
20002822	AW1571	CARR RANCH	GONZALES	45.8	0	ROW	Lettuce, Leaf	Cauliflower	Celery		1
20004304	AW1574	Nipomo	Nipomo	3	0	GREENHOUSE					1
20003647	AW1583	Newell Vineyards	Lockwood	17	0	VINEYARD	Grapes, Wine				1
20007852	AW1585	Rancho Sin Frenos	Carmel Valley	15	0	VINEYARD					1
20001008	AW1586	Heller Estate	Carmel Valley	107	107	VINEYARD	Grapes, Wine				1
20004779	AW1588	Rio Seco Vineyard & Winery	Paso Robles	30	0	VINEYARD					1
20001161	AW1589	Red Cedar Vineyards	Shandon	1727	0	VINEYARD					1
20002655	AW1590	TCR	Watsonville	9.5	0	ROW	Strawberry				1
20000790	AW1592	Erwin Vineyard	Los Gatos	3	0	VINEYARD	Grapes, Wine	Grapes, Wine	Grapes, Wine		1
20003893	AW1594	Rose/Cowles Berry Farm	Watsonville	7.82	0	ROW	Blackberry				1
20003873	AW1594	Cowles Ranch #2/Cowles Berry Farm	Watsonville	25.84	0	ROW	Blackberry				1
20003866	AW1594	Cowles Ranch #1/Cowles Berry Farm	Watsonville	5.92	0	ROW	Blackberry				1
20003882	AW1594	Ollason Ranch/Cowles Berry Farm	Watsonville	9.75	0	ROW	Blackberry				1
20012104	AW1596	DSA	Aromas	10	0	ROW	Raspberry				1
20012107	AW1596	Shultz	CA	30.3	0	ROW	Strawberry				1
20012106	AW1596	Ryan	Salinas	31.6	0	ROW	Strawberry				1
20012108	AW1596	Speigel	Salinas	34.6	0	ROW	Strawberry				1
20003638	AW1596	Hillcrown	Aromas	32	64	ROW	Raspberry	Strawberry			1
20012105	AW1596	Loveland	Aromas	86.31	0	ROW	Raspberry	Blackberry			1

20012102	AW1596	Hillcrown	Aromas Ca	24.03	0	ROW	Strawberry	Raspberry		1
20007173	AW1597	REGO FARM	Watsonville	8.5	0	ORCHARD	Avocado	Lemon		1
20005081	AW1601	Casserly	Watsonville	11	0	ROW	Blackberry			1
20001149	AW1603	Ste Philippe Vineyard	Soledad	289.62	0	VINEYARD				1
20001189	AW1603	Ste Nicholas Vineyard	Soledad	171.05	0	VINEYARD				1
20001155	AW1603	Doctor's Vineyard	Soledad	242.77	0	VINEYARD				1
20001153	AW1603	Lone Oak Vineyard	Soledad	146.39	0	VINEYARD				1
20001156	AW1603	Smith & Hook Vineyards	Soledad	277.24	0	VINEYARD, ORCHARD				1
20006421	AW1609	Floradale Ranch	Lompoc	35	0	ROW	Other			1
20001641	AW1610	R. E. Hall Carpinteria, Inc	Carpinteria	52	0	ORCHARD	Avocado			1
20004209	AW1613	LITTLE RANCH	MOSS LANDING	39	1	ROW	Strawberry			1
20009062	AW1613	Kajihara Ranch	Watsonville	46	0	ROW	Strawberry			1
20004200	AW1613	WELSH RANCH	MOSS LANDING	9.5	0	ROW	Strawberry			1
20004203	AW1613	GRACIA RANCH	ROYAL OAKS	35	1	ROW	Strawberry			1
20004216	AW1614	SHEAHY RANCH	WATSONVILLE	47	0	ROW	Strawberry			1
20004215	AW1614	VASQUEZ RANCH	WATSONVILLE	40	0	ROW	Strawberry			1
20003969	AW1616	ROCHA FARMS	WATSONVILLE	41	0.25	ROW	Strawberry			1
20002643	AW1620	NURSERY	Santa Maria	2	2	NURSERY				1
20008550	AW1622	Chap Foster (The Farm)	Salinas	28		ROW	Strawberry	Pumpkin	Corn, Human Con.	1
20003371	AW1632	Mozzini Ranch	King City	74.5	0	VINEYARD				1
20003367	AW1632	Amaral Ranch	King City	186	0	VINEYARD				1
20003375	AW1632	Herbert Ranch	King City	194	0	VINEYARD				1
20003361	AW1632	Wilson Ranch	San Lucas	612	0	VINEYARD				1
20003372	AW1632	Rocky Ranch	Greenfield	97	0	VINEYARD				1
20004659	AW1641	SIP	Salinas	2.6	0	ROW	Lettuce, Leaf			1
20004656	AW1641	Sullivan(Jerry Ramirez)-Vierra	Salinas	24.4	24.4	ROW	Lettuce, Head	Lettuce, Leaf		1
20008407	AW1641	T&A/Naturipe-Fuji-Molera	Salinas	46.1	0	ROW	Strawberry			1
20007896	AW1643	Rider	Watsonville	13	0	ROW	Blackberry	Blueberry		1
20008526	AW1645	Conley Ranch	Salins	39	0	ROW	Strawberry			1
20008406	AW1645	Toro Ranch	Salinas	17.6	0	ROW	Strawberry			1
20008524	AW1645	Weaver Ranch	Salinas	47.1	47.1	ROW	Strawberry			1
20004363	AW1645	Tjerrild Ranch	Salinas	48	48	ROW	Lettuce, Head	Lettuce, Leaf		1
20005029	AW1646	Amaral Ranch	Castroville	12	0	ROW	Strawberry	Blueberry	Barley	1
20004951	AW1646	Meridian Ranch	Castroville	8	8	ROW	Strawberry	Barley	Other	1
20004712	AW1648	Arroyo Seco Canyon Vineyard	Greenfield	71	71	VINEYARD				1
20004738	AW1649	Skillicorn Berries	Watsonville	5.5	0	ROW	Blackberry	Apple		1
20007884	AW1650	idem	Moss Landing	3	0	NURSERY				1
20007873	AW1652	RIDER	WATSONVILLE	33	23	ROW	Blackberry	Blueberry		1
20007858	AW1652	MCGRATH	WATSONVILLE	92	92	ROW	Raspberry	Blackberry		1
20007819	Aw1653	Brinan Ranch	San Ardo	43.6	0	ROW	Lettuce, Head	Carrot	Cucumber	1
20001567	AW1655	Home Ranch	Watsonville	20	40	ROW	Strawberry			1
20001468	AW1656	Lemoravo Ranch	Soledad	98	0	VINEYARD, ORCHARD				1
20001472	AW1656	Highlands Ranch	Soledad	180	0	VINEYARD, ORCHARD				1
20001471	AW1656	Berti Ranch	Soledad	69	0	ORCHARD				1
20001469	AW1656	Fairview Road Ranch	Soledad	245	0	VINEYARD, ORCHARD				1
20001470	AW1656	Escolle Ranch	Soledad	283.5	0	VINEYARD, ORCHARD				1
20001467	AW1656	Old Oak Ranch	Soledad	191	0	ORCHARD				1
20003692	AW1659	Hilltop Ranch	Moss Landing	3		GREENHOUSE				1
20007566	AW1660	Sargenti Ranch	CHUALAR	30	0	VINEYARD	Grapes, Wine			1
20007532	AW1660	CORRAL DE TIERRA	SALINAS	7	0	VINEYARD, ORCHARD	Grapes, Wine	Olive		1
20004455	AW1661	Clark	Soledad	1165.93		VINEYARD				1
20004466	AW1661	Panorama	Soledad	415.95		VINEYARD				1
20004506	AW1661	PDM	Gonzales	284.89		VINEYARD				1
20004516	AW1661	Rincon	Gonzales	223.23		VINEYARD				1
20004515	AW1661	Porter	Gonzales	254.14		VINEYARD				1
20004503	AW1661	Hacienda	Soledad	386.09		VINEYARD				1
20004328	AW1661	Mission Peak	Los Alamos	199.22		VINEYARD	Grapes, Wine			1
20004324	AW1661	Geoffrey Cellars	Los Alamos	199.38		VINEYARD	Grapes, Wine			1
20004331	AW1661	Byron	Santa Maria	382.61	0	VINEYARD				1
20004510	AW1661	Valley View	Gonzales	110.48		VINEYARD				1
20004336	AW1661	Barham Vineyard	Los Alamos	499.93		VINEYARD	Grapes, Wine			1
20004497	AW1661	Rancho Tierra	Soledad	283.55		VINEYARD				1
20004508	AW1661	Jensen	Gonzales	142.85		VINEYARD				1

20004334	AW1661	Sainz	Los Alamos	125.5		VINEYARD	Grapes, Wine			1
20004326	AW1661	Cambria Estate	Santa Maria	1284.11	0	VINEYARD				1
20004330	AW1661	Mission Trails	Los Alamos	480.13		VINEYARD	Grapes, Wine			1
20004333	AW1661	Neely	Los Alamos	105.62		VINEYARD	Grapes, Wine			1
20000570	AW1662	Salinas Valley Nursery	Salinas	3	0	GREENHOUSE	Turnip	Daikon		1
20003202	AW1664	Moranda Ranch	Soledad	40	0	ROW	Broccoli	Lettuce, Leaf		1
20004060	AW1665	F6	watsonville	4	0	ROW, GREENHOUSE	Other	Other	Other	1
20004042	AW1665	F2	san juan bautista, ca	10	0	ROW	Other	Other	Other	1
20004058	AW1665	F7	gilroy	30	0	ROW	Other	Other	Other	1
20004049	AW1665	F4	watsonville	15	0	ROW	Other	Other	Other	1
20004054	AW1665	F5	watsonville	5	0	ROW, GREENHOUSE	Other	Other	Other	1
20004044	AW1665	F3	watsonville	1	0	ROW	Other	Other	Other	1
20007219	AW1673	MILLER BROTHERS FARMING	San Miguel	170	0	VINEYARD				1
20003324	AW1674	Zabala Vineyards	Soledad	679	0	VINEYARD	Grape			1
20003724	AW1675	Central Avenue Vineyard	King City	463	0	VINEYARD				1
20004280	AW1679	ALTMAN PLANTS #6	SALINAS CA.	9	9	NURSERY, GREENHOUSE				1
20004243	AW1679	ALTMAN PLANTS RANCH #`1	SALINAS CA	19	0	NURSERY, GREENHOUSE				1
20004246	AW1679	ALTMAN PLANTS #2	SALINAS CA	20	0	NURSERY, GREENHOUSE				1
20004287	AW1679	ALTMAN PLANTS #5	SALINAS CA.	19	0	NURSERY, GREENHOUSE				1
20004261	AW1679	ALTMAN PLANTS #4	SALINAS CA	20	0	NURSERY, GREENHOUSE				1
20003542	AW1680	Vigna Del Cielo Azzuro	Soledad	7.4	0	VINEYARD				1
20003541	AW1680	Morgantini Vineyard	Paso Robles	40	0	VINEYARD				1
20003538	AW1680	Panziera Brothers Vineyard	Soledad	20	0	VINEYARD				1
20001035	AW1680	Morgantini 3	Paso Robles	63	0	VINEYARD				1
20004437	AW1684	Color Spot Yard 3 - Monterey Rose	Salinas	27	7	NURSERY, GREENHOUSE				1
20004435	AW1684	Color Spot Yard 2 - Ninomiya	Salinas	20	20	NURSERY, GREENHOUSE				1
20000962	AW1693	John D Rarig Ranch	Cayucos	18	18	ORCHARD	Avocado			1
20007537	AW1695	Anthony Freitas Farms	San Juan Bautista	20	0	ORCHARD				1
20001010	AW1698	Jorge's Farm	Watsonville	30	0	NURSERY				1
20003355	AW1702	Ron Anderson	Goleta	4	0	ORCHARD	Avocado			1
20007857	AW1712	Di Gangi Vineyards	Carmel Valley	10	0	VINEYARD				1
20002840	AW1715	El Capitan Ranch/ Indian Valley Ranch	Goleta	3		ORCHARD				1
20000739	AW1716	Buena Vista	Watsonville, Ca 95076	9	0	ROW	Strawberry			1
20000743	AW1716	Tada Ranch	Watsonville	12	0	ROW	Strawberry			1
20000742	AW1716	Casserly Ranch	Watsonville, Ca	5	0	ROW	Strawberry			1
20003949	AW1721	Ponce Produce	watsonville	9.5	1.5	ROW	Blackberry			1
20005176	AW1722	West Bay 101N	Santa Maria	118	0	ROW	Other			1
20012002	AW1722	White Hills - West Ranch #50	Orcutt	91.9	91.9	ROW	Other			1
20008569	AW1722	Bien Nacido Ranch 2012	Garey	50.5	0	ROW	Other			1
20005078	AW1722	Gladaway Warehouse	Santa Maria	2	0	ROW	Other			1
20012022	AW1722	Bradley North Ranch 2012	Santa Maria	146		ROW	Other	Peas		1
20008571	AW1722	Bradley South Ranch 2012	Santa Maria	209	0	ROW	Other			1
20012003	AW1722	White Hills East Ranch #51	Orcutt	109.4	109.4	ROW	Other			1
20005148	AW1723	Ross Orchard	Lompoc	10	0	ORCHARD	Walnut			1
20003870	AW1724	Davis Family Ranch	Summerland	7	0	ORCHARD				1
20003877	AW1724	Grant Ranch	Carpinteria	10	0	ORCHARD				1
20003842	AW1724	William Kimsey	Santa Barbara	19	0	ORCHARD				1
20003856	AW1724	Daniel Rosenbaum	Santa Barbara	15	0	ORCHARD				1
20003864	AW1724	Gerald Cigliano	Summerland	10	0	ORCHARD				1
20003133	AW1725	Taylor Ranch	Nipomo	8	8	ROW	Avocado			1
20000832	AW1728	Sonshine Ranch	Goleta	4.5	4.5	ORCHARD	Avocado			1
20005174	AW1730	Ranch 3	greenfield	338	0	VINEYARD				1
20007550	AW1731	Condor Ridge Ranch/Bloomingdale	Goleta	30	30	ORCHARD				1
20005420	AW1732	Cedar Lane Vineyard	Soledad	55		VINEYARD				1
20004384	AW1733	Miller Merritt Trust Carpinteria	Carpinteria	11.25	0	ORCHARD				1
20001186	AW1735	02 Carrari	Los Alamos	98		VINEYARD	Grapes, Wine			1
20001194	AW1735	03 Los Alamos	Los Alamos	80		VINEYARD	Grapes, Wine			1
20001169	AW1735	01 Valley View	Solvang	39		VINEYARD	Grapes, Wine			1
20001209	AW1735	08 Calzada	Santa Ynez	3		VINEYARD	Grapes, Wine			1
20000890	AW1736	JK Vineyard	solvang	3.5		VINEYARD				1
20003160	AW1737	BUTERA	Goleta	125	0	ORCHARD	Avocado	Lemon		1
20003772	AW1738	Rancho Vinedo	Santa Maria	63	0	ROW, VINEYARD	Oat	Pastureland		1
20003105	AW1740	Nursery - Ranch	Santa Barbara	14	0	NURSERY				1

Enrollment information in the Water Board's GeoTracker data management system as of Aug. 1, 2012.

20003104	AW1740	Nursery	Santa Barbara	16	0	NURSERY				1
20000768	AW1743	Ranch 2	Lompoc	13		ROW	Bean, Unspecified			1
20000770	AW1743	Ranch 1	Lompoc	39		ROW	Bean, Unspecified			1
20000775	AW1743	Ranch 4	Lompoc	80		ROW	Bean, Unspecified			1
20000776	AW1743	Ranch 5	Lompoc	40		ROW	Bean, Dried			1
20005643	AW1746	the poor farm	greenfield	12	0	ROW, VINEYARD, ORCHARD	Broccoli	Lettuce, Head	Strawberry	1
20004087	AW1749	Harvey Vineyards	Bradley	28	0	VINEYARD	Grapes, Wine			1
20002130	AW1753	Unknown	Salinas	5.5	0	GREENHOUSE				1
20000951	AW1758	Vazquez Ranch	Goleta	175		ORCHARD	Avocado	Lemon		1
20000950	AW1758	Jones Ranch	Santa Barbara	11		ORCHARD	Avocado			1
20000947	AW1758	San Jose Ranch	Santa Barbara	18		ORCHARD	Avocado			1
20000955	AW1758	Wells Ranch	Nipomo	54		ORCHARD	Avocado			1
20000954	AW1758	Stephens Ranch	Goleta	20		ORCHARD	Avocado			1
20000945	AW1758	Winchester Ranch	Goleta	340		ORCHARD	Avocado	Lemon		1
20000953	AW1758	Tom Apostol	Goleta	7		ORCHARD	Avocado			1
20000952	AW1758	Miller Ranch	Goleta	9		ORCHARD	Avocado			1
20003047	AW1759	Doud 2	Greenfield	137.2	0	VINEYARD				1
20003043	AW1759	Reliz	Greenfield	11.3	0	VINEYARD				1
20003041	AW1759	Riva	Greenfield	530	0	VINEYARD				1
20003042	AW1759	Doud 1	Greenfield	93.1	0	VINEYARD				1
20000566	AW1760	Santa Fe Ranch	Salinas	7	7	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	1
20003659	AW1761	Ferrasci Ranch	Salinas	31.4	0	ROW	Lettuce, Head	Cauliflower	Spinach	1
20002970	AW1761	Diac Ranch	Salinas	44.4	0	ROW	Lettuce, Head	Cauliflower	Spinach	1
20004090	AW1765	Ranch 4	Santa Maria	41	41	ROW	Broccoli	Lettuce, Head	Cauliflower	1
20004077	AW1765	Ranch 12	Guadalupe	12	12	ROW	Broccoli	Lettuce, Head	Celery	1
20004666	AW1767	Rio Mesa Farms	Watsonville	15	15	ROW	Strawberry			1
20004665	AW1767	Rocha Ranch Airport West	Watsonville	15	15	ROW	Strawberry			1
20004667	AW1767	Rio Mesa Farms	Watsonville	10	10	ROW	Strawberry			1
20000969	AW1780	VOSTI HIGASHI	CHUALAR	45	0	ROW	Lettuce, Head	Broccoli	Lettuce, Leaf	1
20007521	AW1783	A Duda & Sons Seed Mill	Salinas	2	2	NURSERY, GREENHOUSE				1
20006685	AW1786	SIlverado Sweetwater Vineyards	King City	903	0	VINEYARD				1
20006689	AW1786	Wildhorse Vineyard LLC	King City	164	0	VINEYARD				1
20006686	AW1786	Ventana Property Holdings - Ventana Vineyard	Soledad	289.5	0	VINEYARD				1
20006684	AW1786	Sunrise Vineyards	Gonzales	490	0	VINEYARD				1
20006642	AW1786	Kimberly Vineyards	Greenfield	81	0	VINEYARD				1
20010823	AW1786	Brayden's Vineyard	Soledad	35	0	VINEYARD				1
20010822	AW1786	Rick's Vineyard	King City	230	0	VINEYARD				1
20006582	AW1786	Airport Vineyard	Greenfield	94.5	0	VINEYARD				1
20006580	AW1786	Alta Loma Vineyard	Greenfield	250	0	VINEYARD				1
20006540	AW1786	San Saba Vineyards	Soledad	67.75	0	VINEYARD				1
20006621	AW1786	Casa Grande Vineyard	Gonzales	461.14	0	VINEYARD				1
20006581	AW1786	Arroyo Loma Vineyards	Greenfield	980	0	VINEYARD				1
20006644	AW1786	Loma Pacific Vineyards	Greenfield	164	0	VINEYARD				1
20006688	AW1786	Victoria Vineyards	Greenfield	77.7	0	VINEYARD				1
20006640	AW1786	Kristy Vineyard	Greenfield	137	0	VINEYARD				1
20006623	AW1786	Escolle Road Vineyard	Gonzales	125	0	VINEYARD				1
20006647	AW1786	Marsino Vineyard	Greenfield	136	0	VINEYARD				1
20006622	AW1786	Carmel Highlands	Gonzales	186	0	VINEYARD				1
20006680	AW1786	Mission Ranch Vineyard LLC	Soledad	241	0	VINEYARD				1
20006643	AW1786	Los Ositos Vineyard	Greenfield	414	0	VINEYARD				1
20006583	AW1786	Monroe Canyon Vineyard	Greenfield	76.3	0	VINEYARD				1
20006626	AW1786	Garcia Ranch Vineyard	Gonzales	260	0	VINEYARD				1
20006645	AW1786	Lago Vineyard	Greenfield	100	0	VINEYARD				1
20006681	AW1786	McIntyre Vineyards	Gonzales	61.4	0	VINEYARD				1
20006682	AW1786	Rancho Solo Vineyards	Soledad	138	0	VINEYARD				1
20000442	AW1792	san marcos creek vineyards	paso robles	42	42	VINEYARD	Grapes, Wine			1
20001019	AW1796	Sierra Mar	Soledad	38	0	VINEYARD	Grapes, Wine			1
20005502	AW1799	Chula Vina Vineyard	Chualar	12	0	VINEYARD				1
20000983	AW1802	Boekenoogen Vineyard Santa lucia Highlands	Soledad	90		VINEYARD	Grapes, Wine			1
20000984	AW1802	Boekenoogen Vineyard Bell Ranch	Carmel Valley	15		VINEYARD	Grapes, Wine			1
20008239	AW1805	FUJI MOLERA	CASTOVILLE	45.4	45.4	ROW	Strawberry			1
20008244	AW1805	OLD STAGE RANCH	SALINAS	40	40	ROW	Oat			1
20003997	AW1810	Sun Coast Growers	Salians	20.2	0	ROW	Celery	Broccoli	Lettuce, Leaf	1

20004061	AW1810	Garcia Ranch	Salinas	37.4	0	ROW	Celery	Broccoli		1
20007331	AW1814	Ranch 7	Santa Cruz	67	67	ROW	Brussel Sprout			1
20005723	AW1815	14th & Walnut Ave	Greenfield	25.5	0	ROW	Cabbage	Broccoli	Lettuce, Head	1
20003665	AW1816	San Bernabe Vineyard	King City Ca.	5600	0	ROW, VINEYARD	Carrot	Potato	Tomato	1
20007461	AW1819	Thwaits	Watsonville	10	0.5	ROW	Lettuce, Leaf			1
20007562	AW1820	Silva Vineyard	Greenfield	75	75	VINEYARD				1
20007561	AW1820	Hillside Vineyard	Gonzales	200	0	VINEYARD				1
20007554	AW1820	Bella Vita	Greenfield	236	0	VINEYARD				1
20007505	AW1822	Larner Ranch	Solvang	35	0	VINEYARD				1
20004345	AW1823	Cunha Ranch	Salinas	45	45	ROW	Broccoli	Lettuce, Head		1
20001621	AW1823	Spence Ranch Fudenna	Salinas	29.1	0	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf	1
20004723	AW1824	Old Stage Greenhouse	Salinas	5	0	GREENHOUSE				1
20004722	AW1824	Green Valley Floral	Salinas	10	0	GREENHOUSE				1
20004785	AW1828	Black Diamond Ranch/Marin's Vineyard	Lockwood	5	0	VINEYARD				1
20003501	AW1835	33 SCURICH ROAD	WATSONVILLE	8.5	3	ORCHARD	Apple			1
20003481	AW1835	360 CARLTON	WATSONVILLE	8	2	ROW	Raspberry			1
20003470	AW1835	133 SCURICH ROAD	WATSONVILLE	18	3	ROW, ORCHARD	Blackberry	Strawberry	Apple	1
20003813	AW1835	29 Scurich	Watsonville	7	0	ORCHARD				1
20003464	AW1835	55 PECKHAM	WATSONVILLE	8	2	ORCHARD	Apple			1
20003975	AW1840	M. Tashiro Nursery, Inc.	Salinas	7	0	GREENHOUSE				1
20001098	AW1841	Maloy residence	Santa Barbara	0.5	0	ORCHARD	Avocado			1
20005103	AW1842	Gainey Ranch	Santa Ynez, CA 93460	380	0	ROW	Squash	Pumpkin		1
20001575	AW1843	RANCHO ALDEA ANTIGUA, LLC	CARPINTERIA	17	17	ORCHARD				1
20000686	AW1844	Forbidden Fruit Orchards, Inc.	Lompoc	14	0	VINEYARD, ORCHARD	Blueberry	Grapes, Wine	Avocado	1
20001682	AW1845	James A. Brown	Goleta	1		ORCHARD				1
20004520	AW1847	Loma Verde Vineyard	Santa Maria	219	0	VINEYARD				1
20004541	AW1847	El Camino Vineyard	Los Alamos	358		VINEYARD				1
20004512	AW1847	Los Alamos Vineyard	Los Alamos	460	0	VINEYARD				1
20001860	AW1849	6060 La Goleta LLC.	Goleta	26	0	ORCHARD				1
20001527	AW1851	Home Ranch	Watsonville	15		ORCHARD				1
20001528	AW1851	KP	Watsonville	10.1		ORCHARD				1
20004881	AW1854	RANCH 3	NIPOMO	140	0	ORCHARD				1
20003904	AW1855	Joullian Vineyards	Carmel Valley	40	0	VINEYARD	Grapes, Wine			1
20005023	AW1863	Canyon Creek Ranch	Morro Bay	4	3	ORCHARD	Avocado	Pastureland		1
20004743	AW1870	Plant Horizons	Royal Oaks	2	0	NURSERY, GREENHOUSE				1
20007127	AW1871	Cathedral Oaks Village Association	Santa Barbara	0.7	0.7	ORCHARD	Avocado			1
20001573	AW1875	Hector Organic Farm - ALBA	salinas	4.6	4.6	ROW	Strawberry	Cucumber	Tomato	1
20011584	AW1877	Desante	Castroville	257.3	128.6	ROW	Artichoke	Brussel Sprout		1
20011586	AW1877	Sella - Tottino	Castroville	307.5	78	ROW	Artichoke			1
20011583	AW1877	Molera - North	Castroville	379.8	196.3	ROW	Artichoke			1
20011564	AW1877	Giannini	Salinas	277.7	60.2	ROW	Artichoke			1
20011570	AW1877	San Jon - Potter	Salinas	36.9	12.1	ROW	Lettuce, Head			1
20011572	AW1877	M. Hill - Tottino	Castroville	268.6	134.3	ROW	Artichoke			1
20011567	AW1877	Q&B	Salinas	138.5	27.7	ROW	Artichoke			1
20011569	AW1877	San Jon - Barlogio	Salinas	112.6	31.6	ROW	Artichoke			1
20011574	AW1877	M. Hill - Massa	Castroville	172.2	116.5	ROW	Artichoke			1
20011542	AW1877	Nielsen - South	Salinas	218.9	61.4	ROW	Artichoke			1
20001660	AW1879	Margaret's Vineyard	Lockwood	14		VINEYARD				1
20001051	AW1882	Salvador Lazaro	santa ynez	16	0	ROW	Squash, Summer			1
20005328	AW1884	Alegria Ranches	Goleta	33	0	ORCHARD				1
20008162	AW1885	Tom Moyer Farm	santa barbara	3	0	ORCHARD	Avocado			1
20000862	AW1888	OK Avocado Ranch	Nipomo	8	8	ORCHARD	Avocado			1
20008562	AW1891	Harney Ranch	Watsonville	27	27	ROW	Chinese Cabbage	Leek	Parsley	1
20008567	AW1891	Lima Ranch	La Selva	16	16	ROW	Squash	Chinese Cabbage	Endive	1
20008565	AW1891	Storm ranch	Watsonville	40	40	ROW	Broccoli	Cauliflower	Lettuce, Leaf	1
20008561	AW1891	Freedom Ranch	Watsonville	30	30	ROW	Celery	Collard	Lettuce, Leaf	1
20008563	AW1891	Home Ranch	Watsonville	21	21	ROW	Beet	Radish	Rutabega	1
20008566	AW1891	Capurro Ranch	Moss Landing	27	27	ROW	Beet	Kale	Spinach	1
20004588	AW1891	Ramer Ranch	Watsonville	36	36	ROW	Squash, Summer	Bean, Unspecified	Leek	1
20004471	AW1891	Amesti Ranch	Watsonville	28	28	ROW	Lettuce, Head	Leek	Peas	1
20004509	AW1891	Kett Ranch	Watsonville	6	6	ROW	Carrot	Collard	Lettuce, Head	1
20004511	AW1891	Kitayama Ranch	Watsonville	80	80	ROW	Rutabega	Radish	Carrot	1
20004607	AW1891	Rosa Ranch	Watsonville	9	9	ROW	Lettuce, Leaf	Bean, Unspecified	Spinach	1

20004644	AW1891	Packard Ranch	Moss Landing	44	44	ROW	Broccoli	Cauliflower	Lettuce, Leaf	1
20004651	AW1891	Ranch 1A	Watsonville	6	6	ORCHARD				1
20004481	AW1891	Braycovich Ranch	Watsonville	35	35	ROW	Beet	Cabbage	Kale	1
20004563	AW1891	Monterey Bay Academy aka, Academia, aka MBA	Watsonville	47	24	ROW	Lettuce, Leaf	Kale	Collard	1
20004653	AW1891	Ranch 2A	Watsonville	8	8	ORCHARD				1
20004467	AW1891	Airport Ranch	Watsonville	20	20	ROW	Cabbage	Lettuce, Head	Chinese Cabbage	1
20005780	AW1893	1	watsonville	0.75	0	ROW, NURSERY	Other			1
20000690	AW1904	G and J Orchards	Hollister	32		ORCHARD				1
20011362	AW1907	Chalone	Soledad	320	0	VINEYARD				1
20005480	AW1908	Aspen Enterprises	Watsonville	8	0	NURSERY, GREENHOUSE				1
20003697	AW1909	Bedding Plants Plus, Inc.	Carpinteria	12	0	NURSERY, GREENHOUSE				1
20007307	AW1910	Jones Vineyard	Hollister	4	0	VINEYARD				1
20005346	AW1911	Wheelock Road ,Watsonville,ca.	Watsonville	3.5	0	NURSERY				1
20002567	AW1912	Whale Rock Ranch	Cayucos	40		ORCHARD				1
20002753	AW1913	OLEA FARM	TEMPLETON	3	0	ORCHARD				1
20008034	AW1914	Horace Lee Hillard Walnut Orchard	Hollister	4	0	ORCHARD	Wheat			1
20003027	AW1915	Terra Ventosa Vineyard	King City	2115	0	VINEYARD	Grapes, Wine			1
20003026	AW1915	Pine Creek Ranch	San Ardo	1264	0	VINEYARD	Grapes, Wine			1
20003451	AW1915	Keyes Canyon Ranches	San Miguel	630	0	VINEYARD	Grapes, Wine			1
20007646	AW1916	Overley Growers	Nipomo	1	0	ROW, NURSERY, GREENHOUSE	Tomato			1
20005046	AW1918	Premium Pistachio LLC	Paso Robles	26	0	ORCHARD	Pistachio			1
20002869	AW1923	F&T Vineyard	Shandon	298.9	0	VINEYARD				1
20002929	AW1924	Cerro Prieto Vineyard	Paso Robles	17		VINEYARD				1
20004232	AW1930	Blossom Hill Nursery	watsonville	3		NURSERY				1
20002830	AW1932	Boneso Home Vineyard	San Miguel	8	0	VINEYARD				1
20002826	AW1932	Cole Creek Vineyard	Templeton	32	0	VINEYARD				1
20002871	AW1934	Rancho Tecolote	Goleta	20	20	ROW, ORCHARD	Avocado			1
20004389	AW1936	Mann Ranch	Watsonville	24	24	ROW	Lettuce, Leaf			1
20004387	AW1936	Beilby Ranch	Watsonville	41	41	ROW	Blackberry	Raspberry	Strawberry	1
20004399	AW1936	Riverside Ranch	Watsonville	37	37	ROW	Strawberry	Raspberry		1
20000594	AW1937	ANGEL VINEYARDS	ARROYO GRANDE	2	0	VINEYARD				1
20007574	Aw1939	Sanctuary Vineyards	Greenfield Ca.	184.7	184.7	VINEYARD	Grapes, Wine			1
20003621	AW1943	Four Sisters Ranch	San Miguel	145	0	VINEYARD				1
20001883	AW1945	Lucy M. Walsh	San Martin	17	0	ORCHARD	Walnut			1
20009442	AW1950	Redwing Vineyards	Gilroy	2	2	VINEYARD				1
20003625	AW1953	Oak Creek Vineyard	Paso Robles	38	0	VINEYARD	Grapes, Wine			1
20001716	AW1958	Old Crumudgeon Vineyard	Lockwood	4.9		VINEYARD				1
20004762	AW1961	Brisas Costeras	Ventura	18	18	ORCHARD	Avocado			1
20004765	AW1961	Rancho Mariposa	Ventura	4	4	ORCHARD				1
20004767	AW1961	Faith Lutheran Church	Carpinteria	1	1	ORCHARD				1
20005086	AW1962	Asbell Orchids	Arroyo Grande	0.5	0	GREENHOUSE				1
20001090	AW1964	Forestieri	Morgan Hill	10	10	ORCHARD	Other			1
20004709	AW1967	Moss Lane Estates	Templeton	11	0	VINEYARD				1
20007282	AW1972	Vincent Castello	Hollister	41	0	ORCHARD				1
20003151	AW1973	same	Santa Barbara	2.5	0	ORCHARD	Avocado			1
20001021	AW1975	Spitzley Farm/Boulder Ridge Vineyard	Cambria, CA 93428	5		VINEYARD, ORCHARD	Grapes, Wine	Avocado		1
20007020	AW1978	McFarland	Goleta	1	0	ORCHARD	Avocado			1
20003215	AW1979	Ahlgren Vineyard	Boulder Creek	1	0	VINEYARD	Grapes, Wine			1
20003103	AW1981	Gilroy Young Plants	Gilroy	30	0	GREENHOUSE				1
20000510	AW1988	Haslett Thomsen Property	Cuyama Valley	23	0	VINEYARD				1
20003560	AW1991	Mt. Green Nursery, Inc.	San Martin	1.5	0	GREENHOUSE				1
20003240	AW1994	Susich Vineyard	Santa Ynez	3.7		VINEYARD				1
20004204	AW1995	Uyeda Farm	Watsonville	29	0	ROW	Strawberry			1
20000988	AW1996	Casa Nuez Macadamias	Gaviota	1.39		ORCHARD				1
20008040	AW1999	home	goleta	3	3	ORCHARD	Avocado			1
20002928	AW2006	Shadow Canyon Vineyard	Paso Robles	11		VINEYARD				1
20005404	AW2009	Rancho de las Noches	Goleta	3	0	ORCHARD	Avocado			1
20007855	AW2012	Rosenberg Family Ranch	San Ardo	366		ROW, ORCHARD	Walnut			1
20003323	AW2014	Ritz Brunello	Santa Barbara	1	0	ORCHARD	Avocado	Citrus		1
20009023	AW2016	Rancho 2	Watsonville	4	4	ROW	Strawberry	Raspberry		1
20009022	AW2016	Rancho 1	Watsonville	5	5	ROW	Strawberry	Raspberry		1
20000745	AW2017	Curtiss Kennon	Holiister	30		ORCHARD	Walnut			1
20000648	AW2019	Schechter Vineyards	Atascadero Ca.	8	0	ROW, VINEYARD	Grapes, Wine			1

20004725	AW2032	JUSTIN Vineyards and Winery	Paso Robles	279.6	0	VINEYARD				1
20000905	AW2034	Sunbelt Vineyard	San Miguel	337	0	VINEYARD				1
20002200	AW2036	EM JAG C Corp	Santa Barbara	68	68	ORCHARD				1
20007834	AW2052	ROSEWATER VINEYARD	Creston, CA	17		ROW, VINEYARD	Grapes, Wine	Grapes, Wine	Grapes, Wine	1
20000598	AW2053	Fletcher Vineyard	Templeton	3	0	VINEYARD				1
20002410	AW2056	Orr Ranch	Santa Barbara	1	0	ORCHARD				1
20003797	AW3003	Ranch 4	Greenfield	16		ROW	Bean, Unspecified	Peas		1
20000640	AW3009	Windy Hill Vineyard	Paso Robles	22	0	VINEYARD				1
20001014	AW3010	Hidden Valley Vineyard	Templeton	14	0	VINEYARD	Grapes, Wine			1
20001511	AW3011	Alisos Vineyard	Los Alamos	42	0	VINEYARD				1
20000844	AW3012	RANCHO SANTA RAYLENE	Nipomo	35	0	ORCHARD	Avocado			1
20007924	AW3013	United Genetics Seeds	Hollister	2.5	2.5	ROW, GREENHOUSE	Tomato	Pepper, Fruiting	Cucumber	1
20001288	AW3014	Tom Moller's Vineyard, sometimes called Moller Vineyard	Gilroy	15	0	VINEYARD				1
20007503	AW3015	RANCH 1	LOMPOC	22	0	ROW, NURSERY	Other			1
20011503	AW3016	Freitas Ranch	San Juan Bautista	10	0	ROW	Lettuce, Head			1
20000712	AW3016	Lavagnino Ranch	San Juan Bautista	11	0	ROW	Lettuce, Head			1
20011502	AW3016	Lavagnino Ranch	San Juan Bautista	39	0	ROW	Pepper, Fruiting	Lettuce, Head		1
20007423	AW3017	HIGH JACK RANCH	MARICOPIA	120	0	ROW	Other			1
20003967	AW3019	GRUL RANCH	WATSONVILLE	6	0	ORCHARD	Apple			1
20002708	AW3021	pezzini farms	castroville	44.5	44.5	ROW	Artichoke			1
20002969	AW3023	Henry George/ Layous	King City	145	0	ROW	Bean, Dried			1
20002968	AW3023	San Bernabe Vineyard	King City	1121	0	ROW	Potato	Bean, Dried	Carrot	1
20001212	AW3023	Rosenberg Family Ranch, LLC	San Ardo	575	0	ROW	Bean, Dried	Carrot	Potato	1
20002465	AW3024	same	Montecito	5	0	ORCHARD	Avocado			1
20004882	AW3025	Third Loop Partners	Nipomo	100	0	ORCHARD				1
20002828	AW3036	Whitney Ranch	Carpinteria	7	7	ROW	Blueberry	Avocado	Citrus	1
20001525	AW3038	Partridge Leigh Vineyard	Paso Robles	4		VINEYARD				1
20001531	AW3039	DW Ranch	Ventura	7	0	ORCHARD				1
20007867	AW3040	San Brenarbe	King City	180	0	ROW	Tomato	Pumpkin		1
20000876	AW3043	Exotic African Flora LLC.	Castroville	30	30	NURSERY				1
20002269	AW3044	Creekside Apple Ranch	Solvang	5	0	ORCHARD				1
20000676	AW3046	Two Dog Farm/Orchard Field	Davenport	2		ROW	Lettuce, Leaf	Squash, Summer	Cabbage	1
20002001	AW3047	Marsalisis Organics	Watsonville	13	0	ORCHARD				1
20002896	AW3048	Galante Vineyards	Carmel Valley	23.9		VINEYARD				1
20001537	AW3049	Mahl Ranch Co.	Ventura	32	0	ORCHARD				1
20007144	AW3052	same	CArpinteria	9	6	ORCHARD	Avocado			1
20001546	AW3053	RANCHO PINI RD	WATSONVILLE	6.5	605	ROW	Strawberry	Strawberry	Strawberry	1
20001547	AW3053	RANCHO MAHER	WATSONVILLE	12	12	ROW	Strawberry	Raspberry	Blackberry	1
20001542	AW3053	RANCHO LA CUCUNA	CASTOVILLE	9	9	ROW	Strawberry	Strawberry	Strawberry	1
20003208	AW3054	The Ranch at Cripple Creek	Paso Robles	13	0	ORCHARD	Olive			1
20007290	AW3055	Sanfilippo Ranch, LLC	Watsonville	24		ROW	Apple			1
20001144	AW3055	Sanfilippo Ranch	Watsonville	24		ROW, ORCHARD	Apple			1
20001060	AW3056	same	Santa Barbara	4.2	0	ORCHARD	Citrus	Avocado		1
20002106	AW3058	Warren Church	Royal Oaks	1.5	0	ORCHARD				1
20003614	AW3060	Tognazzini Ranch	Cayucos	34	34	ORCHARD	Avocado			1
20000662	AW3061	Messori Ranch	Ventura	40	0	ORCHARD				1
20007809	AW3062	Rancho Bernat	Los Olivos	4	0	VINEYARD				1
20007560	AW3064	Crist Home	Carmel Valley	0.6	0	ROW, VINEYARD	Grapes, Wine			1
20003222	AW3065	Bright Spring Ranch	Carpinteria	4	0	NURSERY, ORCHARD	Apple	Peach	Bean, Unspecified	1
20007245	AW3066	Foothill Nursery	Carpinteria	7	7	NURSERY				1
20004416	AW3068	OBERTELLOS NURSERY	WATSONVILLE	7.46		GREENHOUSE				1
20002740	AW3069	vance villa vineyard	hollister	3	0	VINEYARD	Grapes, Wine			1
20004744	AW3070	Casa Blanca Vineyards	Los Olivos	66	0	VINEYARD				1
20007172	AW3071	Joughin Ranch	Santa Ynez	8		VINEYARD				1
20007251	AW3074	MICHAUD VINEYARD	SOLEDAD	28.5	0	VINEYARD				1
20002204	AW3077	Chateau Plaisant	Prunedale	0.5	0	VINEYARD	Grapes, Wine			1
20001267	AW3078	schoch family trust	santa barbara	3	3	ORCHARD	Citrus			1
20002578	AW3079	Sunset Nursery	Watsonville	1	1	NURSERY				1
20000689	AW3080	Webster Vineyard	paso robles	16.5	0	VINEYARD				1
20001563	AW3081	Larry Philip	Goleta	6	6	ORCHARD	Avocado			1
20001140	AW3082	Wennerstrom Family Trust	Goleta	3		ORCHARD				1
20007102	AW3084	Weathering Heights	Ventura	80	0	ORCHARD	Avocado	Lemon		1
20002404	AW3085	Meyr Ranch	Carpinteria	10	10	ORCHARD	Avocado			1

20001068	AW3089	GEORIS VINEYARD	CARMEL VALLEY	16	16	VINEYARD				1
20001608	AW3092	Van Brocklin Berries	salinas	1	0	VINEYARD	Blackberry			1
20002943	AW3094	Prunedale Road	Gilroy	16.3		ORCHARD				1
20001980	AW3095	Toro Canyon Nursery, Inc	Carpinteria	12	0	NURSERY				1
20009662	AW3096	Nelson Family Vineyard	Los Gatos	9	0	VINEYARD	Grapes, Wine			1
20002939	AW3099	Flint Road	Hollister	8		ORCHARD				1
20002938	AW3099	Olympia Orchard	San Juan Bautista	25.45		ORCHARD				1
20002974	AW3100	Oak Creek Apple Ranch	SAn Miguel	56	0	VINEYARD, ORCHARD				1
20002945	AW3104	Home Ranch	San Juan Bautista	62		ORCHARD				1
20002946	AW3104	Kesner Ranch	San Juan Bautista	5		ORCHARD				1
20000757	AW3108	Mike Pulido	Hollister	4		ORCHARD	Walnut			1
20004961	AW3112	Mesa Del Sol Vineyards	Greenfield	7	0	VINEYARD				1
20000744	AW3115	Island View Nursery Incorporated	carpinteria	5.5	0	NURSERY, GREENHOUSE				1
20001800	AW3116	Chandler Ranch	Creston	10.12	0	ROW	Olive	Pistachio		1
20002508	AW3117	Estancia De Los Olivos	Solvang	10		ORCHARD	Olive			1
20002222	AW3119	Sakaue Nursery	Watsonville	1	0.25	GREENHOUSE				1
20004456	AW3120	AJB Vineyards	Paso Robles	9	0	VINEYARD	Grapes, Wine			1
20007604	AW3122	Valencia Creek Farm	Aptos	10	0	ORCHARD				1
20001697	AW3123	Fairview Gardens	Goleta	12		ROW, ORCHARD	Lettuce, Leaf	Bean, Unspecified	Carrot	1
20000569	AW3127	CJ Ranch	Carpinteria	7		ORCHARD	Avocado			1
20000823	AW3128	Sunspot	Watsonville	20	0	NURSERY				1
20000820	AW3128	Suncrest and Sunwest	Watsonville	42	0	NURSERY				1
20007294	AW3130	Doce Robles Winery & Vineyard	Paso Robles	30		VINEYARD				1
20007332	AW3131	SHELDON ORCHARD	GOLETA	4		ORCHARD	Lemon	Orange		1
20002760	AW3132	San Antonio Valley Olive Ranch	Bradley	0	0	ORCHARD	Olive			1
20001533	AW3133	Sunnynoll Christie Vineyard	aptos	24	0	ROW, VINEYARD	Grape			1
20007595	AW3134	Regalado Berry Farm	Watsonville	10	10	ROW	Blackberry	Raspberry		1
20006361	AW3136	Dusty Acres	Carpinteria, Ca 93013	2	0	ORCHARD	Avocado			1
20001109	AW3138	Greensward / New Natives LLC	Aptos	0.27		GREENHOUSE	Peas			1
20001717	AW3139	Soquel Vineyards	Soquel	2.5	0	VINEYARD				1
20007267	AW3140	David Bruce Winery Estate Vineyard	Los Gatos	14.83	0	VINEYARD	Grapes, Wine			1
20007485	AW3141	Jardini Vineyard	Salinas	7	5	VINEYARD				1
20007262	AW3142	Bailard Ranch	Carpinteria	2	0	ORCHARD	Avocado			1
20003771	AW3144	Vititech Vineyards	Creston	150	150	VINEYARD				1
20002759	AW3145	H-A Orchard	Goleta	3	0	ORCHARD	Lemon			1
20003860	AW3147	Johnson Family Vineyard	Los Olivos	2.75	2.75	VINEYARD	Grapes, Wine			1
20000685	AW3151	Apple Creek Ranch	Lompoc	9		ROW	Bean, Unspecified			1
20001073	AW3154	Caroline's Vineyard	Paso Robles	15	0	VINEYARD				1
20001965	AW3156	Miyashita Nursery Inc.	Watsonville	2.8	0	GREENHOUSE	Tomato			1
20002464	AW3158	DeVilbiss Ranch	Santa Barbara, Ca. 93105	3		ORCHARD	Avocado			1
20002559	AW3160	Kessler-Haak Vineyard (formerly Ovation Vineyard)	Lompoc	30	0	VINEYARD				1
20007843	AW3162	Allen Ranch	Chualar	28	0	ROW, VINEYARD	Grapes, Wine			1
20004782	AW3163	Falcon Nest Vineyard and Winery	Paso Robles	53.25	0	ROW, VINEYARD, ORCHARD	Grapes, Wine	Olive		1
20005801	AW3164	Rancho Serape	castroville	6	0	ROW	Strawberry	Squash		1
20005800	AW3164	Sombrero Ranch	castroville	10	0	ROW	Strawberry	Raspberry	Squash	1
20002579	AW3165	Mayer Avocado Ranch	Montecito	3		ORCHARD				1
20007493	aw3166	E&E FARMS	watsonville	11		ROW	Blackberry	Blackberry	Blackberry	1
20007476	AW3168	Pepperhill Ranch	Goleta	3.5	0	ORCHARD	Lemon	Orange		1
20007578	AW3169	Oak Savanna Vineyard	Los Olivos	25	0	VINEYARD	Grapes, Wine			1
20003428	AW3170	McCord	Hollister	14	0	ORCHARD				1
20000599	AW3175	Castle Coastal	Greenfield	125	0	ROW, VINEYARD	Grapes, Wine			1
20007390	AW3177	Quiroz Vineyard	san miguel	4.8	0	VINEYARD				1
20007364	AW3178	El Rancho de Juan Fiesta	Greenfield, Ca. 93927	6	0	VINEYARD				1
20002810	AW3179	Gene Haselhofer	Watsonville	15	0	ORCHARD	Apple			1
20004501	AW3182	Domani Vineyards	Los Gatos	0.46	0	VINEYARD	Grapes, Wine			1
20001418	AW3183	Luna Matta Ranch	Paso Robles	33.5	0	VINEYARD, ORCHARD				1
20000801	AW3184	Ada's Vineyard	Paso Robles	8	0	VINEYARD				1
20003358	AW3185	Sakaue Nursery	Watsonville	1		GREENHOUSE				1
20008982	AW3186	Ignacio Farm	hollister	5	0	ORCHARD	Walnut			1
20003593	AW3187	Ranch 1	Los Alamos	34	0	ROW	Peas	Squash	Pepper, Fruiting	1
20003594	AW3187	Ranch 2	Los Alamos	25	0	ROW	Peas	Squash	Pepper, Fruiting	1
20007393	AW3190	Norman's Nursery Inc	Carpinteria	14	1	NURSERY				1
20001479	AW3191	Landmark Ranch Properties	Carpinteria	10	0	ORCHARD	Avocado			1

20001478	AW3191	Landmark Ranch Properties	Carpinteria	28	0	ORCHARD	Avocado			1
20007143	AW3192	Miramar Ranch	santa BArbara	7.5	0	ORCHARD	Citrus			1
20001593	AW3194	3C Ranch LLC	Salinas	364	0	ROW	Strawberry	Artichoke	Lettuce, Head	1
20007508	AW3196	DAVIS FAMILY LLC	WATSONVILLE	9	0	ORCHARD	Apple	Avocado		1
20007506	AW3196	DAVIS FAMILY LLC	WATSONVILLE	10	0	ORCHARD	Apple			1
20000841	AW3198	DEBUSK VINYARDS	PASO ROBLES	8		VINEYARD				1
20002806	AW3199	Foxdale Farm	Templeton	3.5	3.5	ORCHARD				1
20000773	AW3200	suncoast organic farm	hollister	6	6	VINEYARD, ORCHARD				1
20007472	AW3202	Chisan Orchids Nursery, Inc.	Los Alamos	28	0	GREENHOUSE				1
20007590	AW3205	Hannaniah West Farms	Gilroy	7		ORCHARD	Other			1
20007514	AW3210	Morro Bay Ranch Lt.	Morro Bay	30	0	ROW	Pepper, Fruiting	Bean, Unspecified	Peas	1
20003147	AW3211	Hidden Valley	Royal Oaks	5	0	NURSERY, ORCHARD				1
20008413	AW3212	Casserly	Watsonville	10	10	ROW	Strawberry	Leek	Cucumber	1
20008417	AW3212	Green Valley	Watsonville	12	12	ROW, ORCHARD	Cabbage	Apple	Lettuce, Leaf	1
20008410	AW3212	Hecker Pass	Watsonville	2	1	ROW	Squash, Summer	Potato	Broccoli	1
20008416	AW3212	Green Valley	Watsonville	15	10	ORCHARD	Apple	Raspberry	Onion, Green	1
20008414	AW3212	Litchfield	Watsonville	6	2	ROW, ORCHARD	Pepper, Fruiting	Tomato	Pear	1
20008411	AW3212	Pioneer Ranch	Watsonville	14	2	ROW	Bean, Unspecified	Beet	Kale	1
20002220	AW3216	James Wilkins	Creston	114	0	VINEYARD	Grapes, Wine			1
20007186	AW3218	Sanders Nursery	Carpinteria	2		NURSERY, GREENHOUSE				1
20000966	AW3220	Wind Dance Farm	San Luis Obispo	5	0	ORCHARD	Avocado	Olive		1
20013064	AW3221	Suncoast Nursery	Carpinteria	1.5	0	GREENHOUSE	Other			1
20003198	AW3222	Aver Family Vineyards	Gilroy	5.25	0	VINEYARD				1
20000779	AW3225	102 Hollister Ranch	Gaviota	2.5	0	NURSERY				1
20007831	AW3226	PREVEDELLI FARMS	WATSONVILLE	69	0	ORCHARD	Apple	Bean, Unspecified	Blackberry	1
20012023	AW3227	Nipomo Ranch	Nipomo	79	0	ORCHARD	Lemon	Avocado		1
20003605	AW3229	PESSAGNO WINERY	Salinas	2	2	VINEYARD				1
20001460	AW3231	Babcock Vineyards	Lompoc	95	0	VINEYARD	Grapes, Wine			1
20001462	AW3231	Yardi Vineyard	Lompoc	20	0	VINEYARD	Grapes, Wine			1
20005880	AW3235	Rancho Vierra	salinas	10	0	ROW	Strawberry	Squash	Tomato	1
20003722	AW3240	Arioto-Bosio Partnership	Greenfield	378.02		VINEYARD				1
20008022	AW3242	La Panza Ranch	Santa Margarita	767	0	VINEYARD				1
20005644	AW3245	Mccloskey carp	Carpinteria	28	0	ORCHARD				1
20008043	AW3245	Mccloskey nursery	Goleta	6	0	ORCHARD, GREENHOUSE	Avocado		Other	1
20004801	AW3248	Daylily West	Arroyo Grande	0.12	0	NURSERY				1
20007870	AW3249	Sleepy Hollow B (Sleepy Hollow South)	Salinas	212	0	VINEYARD				1
20007877	AW3249	Diamond T Vineyards	Carmel Valley	17	0	VINEYARD				1
20007876	AW3249	Del Mar Vineyards	gonzales	224		VINEYARD				1
20007853	AW3249	River Road (Sleepy Hollow North)	SALINAS	113	0	VINEYARD				1
20007864	AW3249	Sleepy Hollow A (Sleepy Hollow-West)	Salinas	189	0	VINEYARD				1
20004173	AW3252	Jack Creek Farms	Templeton	6	0	ROW, ORCHARD	Apple	Tomato	Pumpkin	1
20008065	AW3253	Western Nursery	Solvang	3	3	NURSERY				1
20001508	AW3255	Wild Coyote Winery	Paso Robles	10	0	VINEYARD	Grape			1
20000845	AW3261	F & F FARMS	Arroyo Grande	35	0	ORCHARD	Avocado			1
20001305	AW3265	C-Bar Vineyards	San Luis Obispo	2.5	0	VINEYARD				1
20008103	AW3268	Briarwood Vineyards	Templeton	32		VINEYARD				1
20007799	AW3269	Frankel Vineyard / Paso Pistachio	Paso Robles	145	0	VINEYARD, ORCHARD	Grapes, Wine	Pistachio		1
20005334	AW3271	School Ranch	Greenfield	37	0	ROW	Lettuce, Head	Carrot	Cauliflower	1
20005350	AW3273	Cypress	Gonzales	209	0	VINEYARD				1
20005352	AW3273	Raymond	Gonzales	288	0	VINEYARD				1
20005358	AW3273	Vigna Monte Nero	Gonzales	167	0	VINEYARD				1
20005357	AW3273	Bayly	Paicines	122	0	VINEYARD				1
20005349	AW3273	Hahn	Chualar	49	0	VINEYARD				1
20005353	AW3273	Home Ranch 100	Gonzales	9	0	VINEYARD				1
20005351	AW3273	Santa Lucia	Gonzales	199		VINEYARD				1
20005356	AW3273	Cienega Rd	Paicines	156	0	VINEYARD				1
20005347	AW3273	Chualar Ranch	Chualar	912	0	VINEYARD				1
20005348	AW3273	Sharpe	Gonzales	31	0	VINEYARD				1
20005354	AW3273	Redding	Greenfield	31	0	VINEYARD				1
20005355	AW3273	Avila	San Ardo	179	0	VINEYARD				1
20004918	AW3275	Ranch 7	Santa Maria	46	0	ROW	Broccoli	Cauliflower	Lettuce, Head	1
20000460	AW3276	Sardis Hickam Jr & Martha A Hickam	Cambria CA 93428	7	0	ROW, ORCHARD	Avocado			1
20008158	AW3277	DB Partners	Santa Barbara	39	41	ORCHARD	Avocado	Citrus		1

20010102	aw3278	Stenner Creek Ranch	San Luis Obispo	4	4	ORCHARD				1
20007750	aw3281	Varian Ranch	Arroyo Grande	80	0	ORCHARD	Avocado	Citrus		1
20007894	AW3282	Fred Hayes & Son	Lompoc	220	0	ROW	Bean, Unspecified	Wheat	Other	1
20002933	AW3283	Summit	Paso Robles	40		VINEYARD				1
20002936	AW3283	Glenrose	Paso Robles	8		VINEYARD				1
20002934	AW3283	Ridgeline	Paso Robles	3		VINEYARD				1
20007795	AW3284	Manzanita Nursery	Solvang	2	2	NURSERY				1
20002706	AW3285	waters blueberries	santa margarita	18	0	ROW	Blueberry			1
20000545	AW3287	Home Ranch	Greenfield	2.5	0	VINEYARD				1
20010283	AW3289	windfall farms	Paso Robles	50	50	ROW	Pastureland			1
20004818	AW3291	Spanish Springs LLC	Pismo Beach	95	32	VINEYARD				1
20004168	AW3293	Seven Quails Vineyards	Paso Robles, CA 93446	4	0	ROW, VINEYARD	Grapes, Wine			1
20000930	AW3297	Lotani Farms	Paso Robles	17	0	VINEYARD, ORCHARD				1
20001510	AW3299	Barr Creekside Vineyard, LLC	Paso Robles	50	0	VINEYARD, ORCHARD	Grapes, Wine	Olive		1
20004734	AW3300	Spencer Vineyard	Paso Robles	4	0	VINEYARD				1
20004696	AW3302	ALBA	salinas	6	6	ROW	Strawberry	Raspberry	Tomato	1
20004835	AW3305	Snowden Vineyard	San Miguel	48	0	VINEYARD				1
20004839	AW3305	Westside Ranch	Paso Robles	55	0	VINEYARD				1
20004831	AW3305	Smoots Oak Shadow Vineyard	Paso Robles	36	0	VINEYARD				1
20004823	AW3305	Hidden Valley Vineyard	Templeton	15.5	0	VINEYARD				1
20011022	AW3305	Hammersky Vineyards	Paso Robles	23	0	VINEYARD	Grapes, Wine			1
20005038	AW3306	La Casa De Maria	Santa Barbara	7	7	ROW, ORCHARD	Broccoli	Tomato	Lettuce, Leaf	1
20009804	aw3307	Coyote Moon Vineyard	Paso Robles	31	0	VINEYARD	Grapes, Wine			1
20004978	AW3310	Christopher Joyce Vineyard	Paso Robles	8.5	0	VINEYARD				1
20004275	AW3311	Burbank Ranch in Templeton	Templeton	43.1	0	ROW, VINEYARD	Grapes, Wine			1
20000765	AW3314	ARC VINEYARDS	SANTA MARIA	72.7	0	VINEYARD				1
20003029	AW3316	KelNik Vineyards	Templeton	12	0	VINEYARD				1
20003492	AW3317	Creekside Farms	Greenfield	12		ROW	Other			1
20003814	AW3318	FAIRVIEW RANCH	HOLLISTER	21	0	ORCHARD	Apple	Walnut		1
20003782	AW3318	DUNCAN	san juan bautista	15	0	ORCHARD	Apple	Walnut		1
20003802	AW3318	RANCHO SAN JUAN - shop	san juan bautista	34	0	ORCHARD	Apple			1
20003787	AW3318	HOME RANCH	san juan bautista	21	0	ORCHARD	Apple	Walnut		1
20003804	AW3318	RANCHO SAN JUAN-lucy brown/duncan	san juan bautista	10	0	ORCHARD	Apple			1
20003798	AW3318	MORRISON	san juan bautista	15	0	ORCHARD	Apple			1
20003449	AW3320	41 vineyard	Shandon	187	0	VINEYARD				1
20003453	AW3320	Home Ranch	Shandon	302	0	VINEYARD				1
20003446	AW3320	Sin Falta	Shandon	165	0	VINEYARD				1
20003259	AW3322	Daou Mountain Vineyard	Paso Robles	44	0	VINEYARD				1
20003262	AW3322	Daou Home Vineyard	Paso Robles	4.3	0	VINEYARD				1
20000517	AW3323	Ranch 1 Plot 1	Arroyo Grande	0.3	0.3	VINEYARD				1
20003227	AW3326	Zotovich Family Vineyard	Lompoc	36	0	VINEYARD				1
20003226	AW3327	Kellner Vineyard/ Cent Anni	Los Olivos	4.5	0	VINEYARD				1
20008182	AW3328	Rancho Fortunato	Paso Robles	63	0	VINEYARD				1
20000629	AW3328	Los Robles Ranch	Paso Robles	95.5	0	VINEYARD				1
20003230	AW3330	Kimsey Vineyard	Solvang	25	0	VINEYARD				1
20003229	AW3332	John Sebastiano Vineyard	Lompoc	151	0	VINEYARD				1
20001302	AW3334	LUCERO FARMS / HOLLISTER	HOLLISTER	707.8	0	ROW	Tomato	Wheat		1
20003517	AW3337	Tanner Berry	Castroville	27	0	ROW	Strawberry			1
20004691	AW3338	Ranch 3E	Santa Maria	42	0	ROW	Lettuce, Head	Broccoli	Cauliflower	1
20004418	AW3338	Ranch 20 E	Santa Maria	8	0	ROW	Lettuce, Head	Broccoli	Cauliflower	1
20004413	AW3338	Ranch 6 N	Guadalupe	47	0	ROW	Lettuce, Head	Broccoli	Cauliflower	1
20004417	AW3338	Ranch 20 N	Santa Maria	5	0	ROW	Cauliflower	Broccoli	Celery	1
20004687	AW3338	Ranch 3 W	Santa Maria	25	0	ROW	Lettuce, Head	Broccoli	Cauliflower	1
20004702	AW3338	Ranch 4M	Santa Maria	21	0	ROW	Lettuce, Head	Broccoli	Cauliflower	1
20004415	AW3338	Ranch 20 S	Santa Maria	6	0	ROW	Lettuce, Head	Broccoli	Cauliflower	1
20000755	AW3339	Holman Ranch LLC	Carmel Valley , Ca	19	5.88	VINEYARD, ORCHARD	Grapes, Wine	Olive		1
20001125	AW3341	San Andreas	Watsonville	23.16	0	NURSERY, GREENHOUSE				1
20012302	AW3343	Pulido Farms	Hollister	4	0	ORCHARD	Other			1
20001132	AW3344	Alta Cresta Orchard	Paso Robles	5	5	ORCHARD				1
20003377	AW3345	Larner Vineyard	Solvang	35	0	VINEYARD				1
20003177	AW3346	Martian Vineyard	los Alamos	25	0	VINEYARD				1
20003179	AW3347	Jorian Hill	Solvang	7.25	0	VINEYARD				1
20003174	AW3348	Fess Parker Rodneys	Los Olivos	116	0	VINEYARD				1

20001880	AW3349	648 Vetter	Arroyo Grande	0.75	0	ROW	Other			1
20004600	AW3353	Firehouse Vineyard	Paso Robles	138	55	VINEYARD				1
20004583	AW3353	Branch Hill Vineyard	Paso Robles	151	30	VINEYARD				1
20002080	AW3354	Fernandez Farms	Watsonville	9	9	ROW	Strawberry			1
20003774	AW3401	Anthan He Farm	Gilroy	2		GREENHOUSE	Chinese Cabbage			1
20005823	AW3402	Santa BArbara Highlands Vineyard	Ventucopa	747		VINEYARD				1
20004037	AW3404	Bella Monte Vineyards	Paso Robles	9	0	VINEYARD	Grapes, Wine			1
20006040	AW3405	Bernal Greenhouse Main Ranch	salinas	4	4	GREENHOUSE	Other			1
20003145	AW3407	Blankenship Ranch	creston	1	0	VINEYARD				1
20005840	AW3409	Boise Family Ranch	Gaviota	2	0	ORCHARD				1
20003069	AW3410	Ranch #1	San Miguel	6		VINEYARD				1
20004305	AW3411	Brady Vineyard	San Miguel	17.94		VINEYARD	Grapes, Wine			1
20004358	AW3412	Buffalo Chip Vineyard	Paso Robles, CA. 93446	10	0	VINEYARD				1
20002925	AW3417	Creston Ridge Farms	Paso Robles	13	0	VINEYARD				1
20006740	AW3418	Charles Morse	Carpinteria	10		ORCHARD				1
20005841	AW3419	Cinco Hermanos Ranch	Gaviota, CA 93117	5	0	ORCHARD				1
20002942	AW3420	Edward Sellers Vineyard	Paso Robles	17.17	0	VINEYARD				1
20006120	AW3421	Coghlan Vineyard	Santa Ynez	18.05	0	VINEYARD				1
20004614	AW3422	CRESTON HILLS VINEYARD	PASO ROBLES	5	0	VINEYARD				1
20005004	AW3423	PASO WESTSIDE VINEYARDS	PASO ROBLES	29	0	VINEYARD				1
20004998	AW3423	HOG CANYON VINEYARDS	SAN MIGUEL	110	0	VINEYARD				1
20008364	AW3423	RAINBOW VINEYARD	SAN MIGUEL	25	0	VINEYARD				1
20004974	AW3423	CRESTON VINEYARDS	PASO ROBLES	100	0	VINEYARD				1
20005033	AW3423	SAN MIGUEL VINEYARDS	SAN MIGUEL	40	0	VINEYARD				1
20005028	AW3423	CROSS CANYON VINEYARDS	SAN MIGUEL	40	0	VINEYARD				1
20005010	AW3423	ARROYO GRANDE VINEYARDS	ARROYO GRANDE	224	0	VINEYARD				1
20005262	AW3423	KICK ON VINEYARDS	LOS ALAMOS	56	0	VINEYARD				1
20003165	AW3424	Dohmeyer Vineyard	Solvang	8	0	VINEYARD				1
20002930	AW3425	Star View Acres	Paso Robles	7	0	VINEYARD				1
20003028	AW3426	Dry Creek Ranch Vineyard	Paso Robles	14	0	VINEYARD				1
20004268	AW3428	Martella Ranch	salinas	50	50	ROW	Strawberry			1
20002745	AW3429	Erden & Kann	Morro bay	17	0	ORCHARD	Avocado			1
20004606	AW3430	Goodell Vineyard	Paso Robles	55	55	VINEYARD				1
20005403	AW3431	Floricultura Pacific	Salinas	10	0	GREENHOUSE				1
20008420	AW3432	Hedberg Ranch	Salinas	60	0	ROW	Strawberry	Blackberry	Raspberry	1
20004463	AW3432	Bruscia Ranch	Watsonville	16	0	ROW	Blackberry			1
20004458	AW3432	Tynnan Ranch	Watsonville	29	0	ROW	Blackberry			1
20004479	AW3432	Williams Ranch	Salinas	9	3.5	ROW	Strawberry			1
20011722	AW3432	USDA Test Plot	Salinas	6		ROW	Strawberry			1
20004476	AW3432	Miller Ranch	Salinas	12	0	ROW	Strawberry			1
20004478	AW3432	Davis Ranch	Salinas	12	0	ROW	Strawberry			1
20002363	AW3435	mahony ranch	templeton	28	0	VINEYARD	Grapes, Wine			1
20004024	AW3438	Hearst Ranch	San Simeon	6	0	ORCHARD	Avocado			1
20004071	AW3439	Jack Ranch	Cholame	141	0	ORCHARD	Other			1
20004737	AW3440	Heublein Ranch	Cayucos, CA 93430	7	0	ROW, ORCHARD	Avocado	Orange	Grapes, Wine	1
20004908	AW3441	Bunn/Emery Ranch	Salinas	48	0	ROW	Strawberry			1
20003386	AW3443	HOLLISTER RANCH WALNUT 2A	HOLLISTER	47.57	0	ROW	Tomato			1
20003348	AW3443	Hollister ranch Walnut 1A, 1B, 1C & 1D, 156 1HW1, 1HW2, 1HW3	Hollister	268.02	0	ROW	Tomato			1
20007229	AW3444	wilson twin oaks vineyard	templeton	25	0	VINEYARD				1
20007231	AW3444	twin oaks vineyard	templeton	25	0	VINEYARD				1
20007350	AW3444	old ford vineyard	paso robles	9	0	VINEYARD				1
20002707	AW3444	jett lease	san miguel	40	0	VINEYARD				1
20009862	AW3444	vanderberry vineyards	San Miguel	50	0	VINEYARD				1
20003022	AW3445	K C Vineyard	paso robles	13	0	VINEYARD				1
20003678	AW3446	Kelsey See Canyon ranch	San Luis Obispo	3		VINEYARD				1
20003674	AW3446	Kelsey Creston Ranch	Creston	4		VINEYARD				1
20003721	AW3448	La Estancia Vineyard	Gonzales	250	0	VINEYARD				1
20002819	AW3450	Leon Chen Vineyard	Paso Robles	15	0	VINEYARD				1
20006100	AW3452	Lindley Vineyard	Lompoc	6.58	0	VINEYARD				1
20005114	AW3453	Lindquist Ranch and Vineyards	Paso Robles	63	0	VINEYARD				1
20005170	AW3454	Lynne B. Schmitz	San Miguel	10	0	ROW	Onion, Dry			1
20002866	AW3455	Martarita Vineyard	Santa Margarita	767.43	0	VINEYARD				1
20004236	AW3456	McCahon Floral	Watsonville	20		NURSERY, GREENHOUSE				1

20003728	AW3457	Strawberry	Watsonville	5	0	ROW, GREENHOUSE	Other			1
20003726	AW3457	Campagna	Royal Oaks	12	0	ROW, GREENHOUSE	Other	Other	Other	1
20002861	AW3458	Mesa Grande Nursery	Arroyo Grande	1.88	0	NURSERY				1
20002246	AW3459	Willow Creek	Cayucos	12	12	ROW	Peas	Pepper, Fruiting		1
20004034	AW3460	Nick Rhodehamel	Carpinteria	2	0	ORCHARD				1
20004786	AW3461	Olivas de Oro	Creston	100	0	ORCHARD	Olive			1
20003083	AW3462	Paso Ono Vineyard	Paso Robles	30	0	VINEYARD				1
20001629	AW3463	Pear Valley	San Miguel	26.5	26.5	VINEYARD				1
20001628	AW3463	Union Road	Paso Robles	58.09	58.09	VINEYARD				1
20004017	AW3464	Peter Capone	Santa Barbara	7	0	ORCHARD				1
20000874	AW3465	Q Ranch	San Luis Obispo	17	0	ORCHARD	Avocado	Orange		1
20003511	AW3466	QI FA NURSERY	SAN MARTIN	2	0	ROW, GREENHOUSE	Chinese Cabbage	Peas	Lettuce, Leaf	1
20006701	AW3467	Beckwith Vineyards	Paso Robles	16.99	0	VINEYARD				1
20006700	AW3467	RHR	Paso Robles	63	0	VINEYARD				1
20006340	AW3468	Parcelas Principales	Salinas	5.5		ROW	Strawberry	Tomato	Squash, Summer	1
20004790	AW3469	Rivenrock Gardens	Nipomo	0.1		ROW	Other			1
20003469	AW3470	Rock Hollow Vineyard	Solvang	14	0	VINEYARD				1
20005741	AW3471	Roro Farms	watsonville	25	2	ROW	Strawberry	Apple		1
20008570	AW3472	Damm	Hollister	11.3	0	ROW	Blackberry			1
20002873	AW3473	San Juan Vineyard	Shandon	437.4	0	VINEYARD				1
20007405	AW3475	Griffith	Watsonville	11.64	11.64	ROW	Blackberry			1
20005844	AW3476	Sea-Bar Nursery	Gaviota, CA	43	0	NURSERY	Apple			1
20002603	AW3477	Shadow Run Vineyard and Winery	Creston	3.5	0	VINEYARD				1
20003264	AW3478	Sharp's Hill Vineyard	Paso Robles	20.79	0	VINEYARD				1
20002808	AW3480	Catherine's Vineyard	Paso Robles	101.74	0	VINEYARD				1
20009542	AW3483	R bar R Ranch	Watsonville	5	5	VINEYARD				1
20002812	AW3484	Steve & Barbara Erden	Morro Bay	17	0	ORCHARD	Avocado			1
20004245	AW3485	Mc Gowan Ranch	Watsonville	31	31	ROW	Strawberry			1
20004248	AW3485	Mc Gowan Ranch	Watsonville	31	31	ROW	Strawberry			1
20011742	AW3485	Travers Ranch	Watsonville	45	45	ROW	Strawberry			1
20001174	AW3487	Taylorchards	Ventura	128	0	ORCHARD	Avocado	Lemon		1
20005147	AW3488	Camatta Hills Vineyard	Creston	393	0	VINEYARD				1
20005169	AW3488	Meridian Home Vineyard	Paso Robles	572	0	VINEYARD				1
20005225	AW3489	Twin Palms Ranch	Atascadero	10	0	VINEYARD, ORCHARD				1
20005740	AW3490	Morimoto Ranch 1	Salinas	40	0	ROW	Strawberry			1
20005742	AW3490	Encinal Ranch	Salinas	35		ROW	Strawberry			1
20002623	AW3491	Vista Lucia Farms	San Miguel	4	0	ROW, ORCHARD	Olive			1
20003269	AW3492	VZZ	Paso Robles	45.79	0	VINEYARD				1
20004872	AW3493	Wade Rhoades	Cambria	50	0	ROW	Oat	Pastureland	Peas	1
20003479	AW3494	Kingsley Vineyard	Solvang	19	0	VINEYARD				1
20003791	AW3495	Ranch 3	Nipomo	45	0	ROW	Strawberry			1
20003555	AW3496	Wei Liang	Gilroy	5	0	GREENHOUSE				1
20006481	AW3497	Wenzlau Vineyard	Lompoc	12	0	VINEYARD				1
20005006	AW3498	Quinta Del Mar Ranch	nipomo	20	0	VINEYARD				1
20003273	AW3499	Windrock Estates Vineyard	Templeton	1.5	0	ROW, VINEYARD, ORCHARD	Grapes, Wine	Olive		1
20004579	AW3500	Wittstrom Vineyard	Paso Robles	42	0	VINEYARD				1
20003193	AW3502	ranchK3/ Runnels	Nipomo	42.9	42.9	ROW	Broccoli	Cauliflower	Lettuce, Head	1
20003188	AW3502	ranch K1	Nipomo	11.3	0	ROW	Broccoli			1
20004441	AW3504	Pinnacles Vineyard	Soledad	1171	0	VINEYARD	Grapes, Wine			1
20004433	AW3504	Bianchi Vineyard	Soledad	750	0	VINEYARD	Grapes, Wine			1
20004449	AW3504	Gabilan Vineyard	Soledad	375	0	VINEYARD	Grapes, Wine			1
20004436	AW3504	Stonewall Vineyard	Gonzales	86	0	VINEYARD	Grapes, Wine			1
20001433	AW3505	Whale Rock, Cobble Creek, Stone's Throw,et al	Templeton	789	0	VINEYARD				1
20006980	AW3506	Shandon Hills VIneyard	Shandon	623	0	VINEYARD				1
20006981	AW3507	Red Hills VIneyard	Creston	260	0	VINEYARD				1
20005861	AW3509	HAO DA FARM	GILROY	5	0	GREENHOUSE				1
20000958	AW3511	KMJ, Assoc.	Hollister	32	0	ROW, VINEYARD	Barley	Pastureland		1
20007517	AW3512	Twist Ranch	Creston	30	0	VINEYARD				1
20007516	AW3512	Big De Farms	Paso Robles	115.9		VINEYARD				1
20007525	AW3513	Big Red Vineyard	Paso Robles	53.29		VINEYARD				1
20007895	AW3514	Aromas Ranch	Aromas	15	15	ROW	Raspberry	Strawberry		1
20007897	AW3514	Porter Ranch	Watsonville	14	0	ROW	Raspberry			1
20013362	AW3515	Aromas Ranch	Aromas	15	15	ROW	Strawberry			1

20008057	AW3517	2 horse vineyard	santa Margarita	5	0	VINEYARD	Grapes, Wine			1
20007703	AW3518	Amivida Vineyard	Santa Margarita	4.5	4.5	ROW, VINEYARD	Grapes, Wine			1
20007790	AW3521	Casa Milagro	Morro Bay	7	0	ORCHARD	Avocado			1
20008004	AW3523	6	Santa Maria	6	0	ROW	Strawberry			1
20008042	AW3525	E&J Gallo	San Luis Obispo	44.2	0	VINEYARD				1
20011822	AW3526	Stowel Rd Ranch	Santa Maria	31	31	ROW	Strawberry			1
20011842	AW3526	La Mula	Santa maria	32	32	ROW	Strawberry			1
20007291	AW3527	Fishman Farm	cayucos							1
20007875	AW3528	Casserly	Wastonville	7	7	NURSERY				1
20008262	AW3530	Heritage Farms	Salinas	4		ROW	Broccoli			1
20007740	AW3532	Moreno	Los Olivos, CA 93441	40	0	ROW	Squash	Pepper, Fruiting		1
20008533	AW3533	Jian Hui Cao	Gilroy	10	0	ROW, GREENHOUSE	Chinese Cabbage			1
20007866	AW3534	Tonini Ranch	San Luis Obispo	46		ROW	Peas			1
20008510	AW3535	Karman Kwong Nursery	San Martin	2	0	GREENHOUSE				1
20007902	AW3542	Surfkist Farm	Morro Bay	18	18	ORCHARD				1
20008002	AW3543	PMR Vineyards	Templeton	34		VINEYARD				1
20007501	AW3546	La Paloma Ranch	Goleta	0.5	0	NURSERY				1
20007600	AW3547	Shoemaker Vineyard	San Miguel	12	0	VINEYARD	Grape			1
20008044	AW3548	Speizer Family Farm	San Luis Obispo	18.02	0	VINEYARD				1
20007659	AW3549	Summerset Ranch	Templeton	2	0	ORCHARD				1
20007872	AW3550	Tackitt Family Vineyards	San Miguel	3	0	ROW, VINEYARD	Grapes, Wine			1
20007811	AW3551	Robins Roost	Watsonville	3.5	3.5	ORCHARD	Apple			1
20007568	AW3553	Manns	Watsonville	32	0	ROW	Blackberry			1
20007817	AW3555	Longo Farm	Gilroy	8		GREENHOUSE	Spinach	Chinese Cabbage	Celery	1
20009302	AW3556	Tangs Farm	San Martin	3		ROW	Chinese Cabbage			1
20009082	AW3557	Rancho Guacamole	Goleta	360	0	ORCHARD	Avocado	Lemon		1
20008822	AW3560	Clark Valley Organic Farm	Los Osos,	5	0	GREENHOUSE	Strawberry	Broccoli	Corn, Human Con.	1
20008742	AW3561	eagle ridge vineyard	san miguel	50	0	VINEYARD				1
20009322	AW3563	Zhen Zhoo Wang	Morgan Hill	2.5		ROW	Other			1
20007906	AW3566	Mumper	Creston	7	7	ROW	Onion, Dry			1
20007901	AW3566	DLP Ag Partnership	Creston	21	15	ROW	Onion, Dry			1
20007996	AW3566	Smith	Creston	4	4	ROW	Onion, Dry			1
20010502	AW3567	CLARK RANCH	SANTA MARIA	76	76	ROW	Blackberry	Raspberry	Other	1
20009682	AW3569	Farming Nuts LLC	Hollister	35	0	ORCHARD	Walnut			1
20010523	AW3571	Gartner Orchard	Hollister	4.6	0	ORCHARD	Other			1
20010682	AW3572	St. Eva Hill Vineyard	San Miguel	8	0	VINEYARD				1
20009882	AW3577	Dawn Ranch	Nipomo	18	12	ROW	Blueberry	Raspberry	Blackberry	1
20010825	AW3579	Cypress Vineyard	Chualar	281	0	VINEYARD				1
20010828	AW3579	Avila Vineyard	San Ardo	180	0	VINEYARD				1
20010827	AW3579	Redding Vineyard	Greenfield	36	0	VINEYARD				1
20010826	AW3579	Santa Lucia Vineyard	Chualar	221	0	VINEYARD				1
20010824	AW3579	Danny's Vineyard	Chualar	330	0	VINEYARD				1
20011122	AW3580	Bassi Ranch	Avila Beach	30	0	VINEYARD				1
20011343	AW3581	Tefft St	Nipomo	35	0	ORCHARD	Citrus	Avocado		1
20011342	AW3581	Haggerty Way	Nipomo	60	0	ORCHARD	Avocado	Citrus		1
20012082	AW3584	Fly	Watsonville	19	0	ROW	Strawberry			1
20012086	AW3584	Tarp	Salinas	25.78	0	ROW	Strawberry			1
20012083	AW3584	Higaki	Watsonville	23.86	0	ROW	Strawberry			1
20011802	AW3585	Rancho Oso Cazador	Santa Barbara	20		ORCHARD				1
20012625	AW3586	San Miguel Olive Farm	San Miguel	10	10	ROW, ORCHARD	Olive			1
20012345	AW3587	Casa Pau Hana Olive Farm, LLC	Paso Robles	5		ORCHARD				1
20012362	AW3588	Rancho Rendezvous Farms	Paso Robles	3.75	3.75	ROW, ORCHARD	Olive			1
20012482	AW3589	George Goodall	Santa Barbara	1.2	1.2	ORCHARD	Avocado			1
20012322	AW3590	Kitehawk Farm	Atascadero	3.4	3.4	ORCHARD				1
20012282	AW3592	Boyd	santa maria	35	35	ROW	Strawberry			1
20011765	AW3594	Pierini Vineyard	Paso Robles	12	2	VINEYARD				1
20012123	AW3595	Rancho Boa Vista	Solvang	10	0	VINEYARD				1
20012122	AW3596	Grimm Vineyard	Santa Ynez	13	0	VINEYARD				1
20012109	AW3597	Summerwood Vineyards	Paso Robles	36	0	VINEYARD				1
20012025	AW3599	Mirabella Vineyard	Los Olivos	6.75	0	VINEYARD				1
20012024	AW3600	Camp 4	Santa Ynez	260	0	VINEYARD				1
20011902	AW3602	Sunshine Floral Inc.	Carpinteria	4	4	GREENHOUSE	Other			1
20011702	AW3606	J. MACHADO RANCH	SANTA MARIA	3.12	0	VINEYARD				1

20012842	AW3608	Reifers Family Vineyard	Templton	4	0	VINEYARD				1
20012802	AW3609	Beruli Vineyards	Paso Robles	7	0	VINEYARD				1
20012762	AW3611	Plum Orchard Lane Vineyard	Templeton	12.1	0	VINEYARD	Grapes, Wine			1
20013087	AW3612	Branch Mill Organic Farm	Arroyo Grande	6	0	ROW, ORCHARD, GREENHOUSE	Bean, Unspecified	Squash	Corn, Human Con.	1
20012242	AW3613	MJ Fronty	San Miguel	22	0	VINEYARD				1
20012705	AW3614	Hoyt Family Vineyard	Paso Robles	5	0	VINEYARD				1
20012704	AW3615	Creston Cripple Creek LLC.	Paso Robles	7	0	VINEYARD				1
20012626	AW3616	Alegre Vineyard	Paso Robles	9.5	0	VINEYARD				1
20012862	AW3617	Putnam Ranch	Morro Bay	3.9	3.9	ORCHARD	Avocado			1
20012942	AW3618	Santa Ynez Valley Farms LLC	Buellton	44	44	ROW, ORCHARD	Corn, Human Con.	Other	Other	1
20013044	AW3620	Home Ranch	Salinas	28.83	0	ROW	Strawberry			1
20013043	AW3620	Davis	Salinas	20.26	20.26	ROW	Strawberry			1
20013046	AW3621	Davis	Salinas	15.86	15.86	ROW	Strawberry			1
20013302	AW3623	Oak Pass Vineyard	Paso Robles	13	0	VINEYARD	Grapes, Wine			1
20012642	AW3625	Olivers Twist Vineyard	Templton	21	0	VINEYARD				1
20000741	AW3634	Almond Hill Vineyard	Paso Robles	7.5	0	VINEYARD				1
20003515	AW4501	Aubaine Vineyard	Nipomo	13	0	VINEYARD				1
20000788	AW4502	kick on vineyard	los alamos	110	0	VINEYARD				1
20001190	AW4504	Diamond AG Vineyards	Paso Robles, CA.	18	0	VINEYARD	Grapes, Wine			1
20001184	AW4505	Gelfand Vineyards	Paso Robles	10	0	VINEYARD	Grapes, Wine			1
20004742	AW4506	Vista Del Paso Vineyards	Paso Robles	8	0	VINEYARD, ORCHARD	Grapes, Wine	Olive		1
20003741	AW4507	Algunas Dias Vineyards	San Miguel	22.5	0	VINEYARD, ORCHARD	Grapes, Wine	Olive		1
20001148	AW4508	Cuevas Vineyards	San Miguel, CA.	41	0	VINEYARD	Grapes, Wine			1
20007497	AW4509	Counsel Oaks	san miguel	2.7	0	ORCHARD	Olive			1
20002503	AW4512	Judd Ranch	San Miguel	32	0	VINEYARD	Grapes, Wine			1
20001150	AW4513	Pleasant Ridge Vineyards	San Miguel, CA	57	0	VINEYARD	Grapes, Wine			1
20000938	AW4514	OSO LIBRE RANCH & VINEYARD	Paso Robles	17	0	VINEYARD				1
20003332	AW4515	Loma Linda Vineyards LLC	Paso Robles	19	0	VINEYARD	Grapes, Wine			1
20001566	AW4516	Simpson Vineyards	Paso Robles	11	0	VINEYARD	Grapes, Wine			1
20001498	AW4517	Wine-Bush Vineyards	Paso Robles	20	0	VINEYARD	Grapes, Wine			1
20001284	AW4518	Sundance Hills Vineyards	Paso Robles	12	0	VINEYARD	Grapes, Wine			1
20003333	AW4519	Clark Ranch	Shandon	12.5	0	VINEYARD, ORCHARD	Grapes, Wine	Olive		1
20002364	AW4522	DeHaesleer Vineyard	Templeton	4	0	VINEYARD				1
20002413	AW4523	Spring Creek Vineyard	Templeton	26	0	VINEYARD				1
20007709	AW4527	Kiler Grove Winegrowers	Paso Robles	10	0	VINEYARD	Grape			1
20008056	AW4529	Creston Hills Vineyard	Creston	9	9	VINEYARD				1
20002921	AW4530	Inangeo Vineyard	Templeton	10.2		VINEYARD				1
20002137	AW4532	Andersen Vineyard	Templeton	8	0	VINEYARD				1
20007160	AW4533	Irick Vineyard	Paso Robles	5.2	0	VINEYARD				1
20001644	AW4534	Verlander Vineyard	Atascadero	5	0	VINEYARD				1
20003196	AW4535	ELLIOT LEWICKI RANCH & VINEYARD	PASO ROBLES	8	0	VINEYARD				1
20002320	AW4536	Laraneta Vineyard	Templeton	16.5	0	VINEYARD, ORCHARD				1
20002362	AW4537	Holly Hock Vineyard	Templeton	8	0	VINEYARD				1
20000465	AW4539	Melange du Rhone Vineyard	Templeton	10.5	0	VINEYARD				1
20000646	AW4541	Dawson Creek Vineyard	Templeton	7.4	0	VINEYARD	Grapes, Wine			1
20002365	AW4542	GreMark Vineyard	Paso Robles	9	0	VINEYARD				1
20006280	AW4544	Beato Vineyard	Templeton	8	0	VINEYARD				1
20003900	AW4545	Strawridge Vineyard	Creston	13.75		VINEYARD				1
20003979	AW4546	Rancho Picacho	Arroyo Grande	32		ORCHARD	Avocado			1
20003972	AW4547	Mahoney Bros., Inc - Ranch #7	Santa Maria	34	0	ROW, ORCHARD	Blueberry	Avocado	Broccoli	1
20007815	AW4548	SOLANA FARMS	San Miguel	26	0	VINEYARD, ORCHARD	Grapes, Wine	Olive		1
20004746	AW4549	Indian Valley Vineyards #2	San Miguel	22.5	0	VINEYARD	Grapes, Wine			1
20001274	AW4550	Pianetta Vineyards	San Miguel	30	0	VINEYARD	Grapes, Wine			1
20001473	AW4551	Vallino/Radogna Vineyards	Paso Robles	10	0	VINEYARD	Grapes, Wine			1
20001165	AW4556	Joseph Vineyard Estates	Bradley	430	0	VINEYARD				1
20004349	AW4557	Steiner Creek Vineyard	Cambria	21.5	0	VINEYARD, ORCHARD				1
20004591	AW4557	Rim Rock Vineyard	Nipomo	5.5	0	VINEYARD				1
20003306	AW4559	Deer Park Vineyard	Aptos	15	0	VINEYARD				1
20003315	AW4560	Alfaro Family Vineyard	Corralitos	25	0	VINEYARD				1
20004423	AW4561	Ranch #8 - Mehlschau	San Luis Obispo	26	0	ROW	Tomato	Squash, Summer	Pepper, Fruiting	1
20004421	AW4561	Ranch #5 - Tank Farm	San Luis Obispo	60	0	ROW	Wheat	Oat		1
20002908	AW4564	Curtis Winery	Los Olivos	108	0	VINEYARD				1
20001039	AW4566	Bello Ranch/ Talley Farms	Arroyo Grande	54	54	ORCHARD				1

Enrollment information in the Water Board's GeoTracker data management system as of Aug. 1, 2012.

20001027	AW4566	Pennington Ranch/ Talley Farms	Arroyo Grande	14	0	ORCHARD				1
20001025	AW4566	Adobe Ranch/ Talley Farms	Arroyo Grande	82	13	VINEYARD				1
20001040	AW4566	Biddle Ranch/ Talley Farms	Arroyo Grande	16	0	ORCHARD				1
20001047	AW4566	Finney Ranch/ Talley Farms	San Luis Obispo	63	20	VINEYARD				1
20001032	AW4566	Donovan/ Talley Farms	Arroyo Grande	29	5	VINEYARD				1
20001049	AW4566	Neal Springs Vineyard/ Talley Farms	Templeton	32	0	VINEYARD				1
20002832	AW4568	Dino Boneso Vineyard	Paso Robles	74	0	VINEYARD				1
20004278	AW4571	Caliza Vineyard / Anderson Road	Paso Robles	18	0	ROW, VINEYARD	Grapes, Wine			1
20003231	AW4573	Thompson	Los Alamos	45	0	VINEYARD				1
20003232	AW4574	MBK @ Jonata	Solvang	82	0	VINEYARD				1
20003233	AW4574	MBK @ S & B	Lompoc	26	0	VINEYARD				1
20003224	AW4575	Rancho Las Hermanas	Lompoc	212	0	VINEYARD				1
20003225	AW4575	Firestone LP @ RLH	Lompoc	43	0	VINEYARD				1
20003184	AW4576	Gainey Main	Santa Ynez	98	0	VINEYARD				1
20003185	AW4576	Gainey Evan Ranch	Buellton	53	0	VINEYARD				1
20003186	AW4576	Gainey Ezperanza	Lompoc	50	0	VINEYARD				1
20003178	AW4577	Honea Vineyard	Solvang	19	0	VINEYARD				1
20003169	AW4578	Magail Vineyard	Los Olivos	1.5	0	VINEYARD				1
20003173	AW4579	Stolpman Vineyard	Solvang	153	0	VINEYARD				1
20003172	AW4584	Three Creek	Santa Ynez	27	0	VINEYARD				1
20003339	AW4587	Hilliard Bruce Vineyard	lompoc	21	0	VINEYARD				1
20003247	AW4588	S & B Vineyard	lompoc	108	0	VINEYARD				1
20003236	AW4591	Grassini Family Vineyard	Santa Ynez	34	0	VINEYARD				1
20003347	AW4592	Ampelos Cellars Vineyard	lompoc	25	0	VINEYARD				1
20003350	AW4593	Fiddlesticks Vineyard	lompoc	97	0	VINEYARD				1
20003437	AW4594	Evergreen Arabians	Los Olivos	51	0	VINEYARD				1
20003379	AW4596	Rancho Colina North	Solvang	4	0	VINEYARD				1
20003378	AW4596	Rusack Vineyard	Solvang	18	0	VINEYARD				1
20003435	AW4597	Harrison Clarke	Solvang	12	0	VINEYARD				1
20003182	AW4598	Jack McGinley/Westerly	Santa Ynez	82	0	VINEYARD				1
20003431	AW4599	Watch Hill Vineyard	Los Alamos	20	0	VINEYARD				1
20000786	AW4602	ROBLAR VINEYARD	SANT YNEZ	16	0	VINEYARD				1
20000761	AW4603	RIVERBENCH VINEYARD	SANTA MARIA	344.06	0	VINEYARD				1
20000787	AW4604	WHITE HILLS	SANTA MARIA	1883	0	VINEYARD, ORCHARD				1
20008902	AW4604	RANCHO LOS ALAMOS	LOS ALAMOS	300	0	VINEYARD				1
20004396	AW4605	North Canyon Vineyard	Santa Maria	930.7	0	VINEYARD				1
20004388	AW4606	Cat Canyon Vineyard	Los Alamos	801.5	0	VINEYARD				1
20001426	AW4607	McCoy Creek Vineyards	Gonzales	962	0	VINEYARD				1
20008124	AW4607	West Pinnicales Vineyard	Soledad	55		VINEYARD				1
20008122	AW4607	Cotta Ranch	Creston	225.2		VINEYARD				1
20010542	AW4608	SANTA MARIA WAY RANCH	SANTA MARIA	55		ROW	Blueberry			1
20011963	AW4608	BULL CANYON RANCH	Santa Maria	65	0	ROW	Raspberry			1
20011965	AW4608	SUEY BOWL	Santa Maria	83	0	ROW	Raspberry			1
20009723	AW4608	TRAVIS RANCH	Santa Maria	20	0	ROW	Raspberry			1
20009742	AW4608	TOGNAZZINI RANCH	SANTA MARIA	35	0	ROW	Raspberry			1
20009762	AW4608	HUTCHERSON RANCH	SANTA MARIA	7	0	ROW	Strawberry			1
20001224	AW4609	Upper Binsacca	Soledad	40	0	ROW	Broccoli	Lettuce, Leaf	Celery	1
20001234	AW4609	Costa Brothers Roddick Ranch	Soledad	5.09	0	VINEYARD				1
20004748	AW4611	Rancho Caballo (RC)	Arroyo Grande	15	0	ROW	Strawberry	Blueberry	Blackberry	1
20003359	AW4612	Cass Vineyard	Paso Robles	146	146	VINEYARD				1
20003633	AW4613	Hilltop Ranch	Paso Robles	137	137	VINEYARD				1
20003634	AW4614	Belli Acres	Paso Robles	24		VINEYARD				1
20003740	AW4616	San Cayetano / Waugaman Ranch	Watsonville	46	0	ROW	Strawberry			1
20004549	AW4617	Carroll Ranch	San Luis Obispo	19.4	0	VINEYARD				1
20004545	AW4617	Fred Righetti Ranch	San Luis Obispo	74.01	0	VINEYARD				1
20004546	AW4617	Braun Ranch	San Luis Obispo	17.5	0	VINEYARD				1
20004540	AW4617	Roger Righetti Ranch	San Luis Obispo	59.2	0	VINEYARD				1
20004580	AW4618	Jack Ranch	San Luis Obispo	142.9	0	VINEYARD				1
20004576	AW4618	Odyssey/Thurlestone Vineyard	San Luis Obispo	77.2	0	VINEYARD				1
20004430	AW4619	Paragon Vineyards	San Luis Obispo	771.2	0	VINEYARD				1
20004608	AW4623	John Silva Vineyard	San Luis Obispo	22.1	0	VINEYARD				1
20004615	AW4625	San Floriano Vineyard	San Luis Obispo	2	0	VINEYARD				1
20004613	AW4625	Donati Vineyard	San Luis Obispo	2.1	0	VINEYARD				1

20004380	AW4627	Wheelock Ranch	Watsonville	15		ROW	Strawberry	Raspberry	Blackberry		1
20004378	AW4627	Pioneer Ranch	Watsonville	18		ROW	Strawberry	Raspberry	Blackberry		1
20006241	AW4628	Villa San Juliette	San Miguel	132	0	VINEYARD					1
20004993	AW4629	Shikuma	Watsonville	24	0	ROW	Blackberry				1
20007823	AW4629	Meridian	Castroville	38		ROW	Strawberry				1
20004972	AW4629	Meridian	Castroville	100	0	ROW	Blackberry	Raspberry			1
20010642	AW5001	New Ranch 2	San Luis Obispo	0	0	VINEYARD					1
20010322	AW5001	Regional Water Board	San Luis Obispo	0		VINEYARD					1
20010122	AW5001	New Ranch	San Luis Obispo	10	20	VINEYARD					1
20002618	AW0142	Metz Ranch - Location #9	Soledad	63	0	ROW	Broccoli	Carrot	Cucumber		2
20002612	AW0142	Jim Guidotti Ranch - Location #3	Soledad	166	0	ROW	Lettuce, Head	Broccoli	Peas		2
20002616	AW0142	Lanini Ranch - Location #8	Soledad	115	0	ROW	Lettuce, Head	Broccoli	Peas		2
20002606	AW0142	Elmer Guidotti Ranch - Location #1	Soledad	117	0	ROW	Lettuce, Head	Broccoli	Peas		2
20002613	AW0142	Martin Clark Ranch - Location #5	Soledad	63	43	ROW, VINEYARD	Lettuce, Head	Broccoli	Bean, Dried		2
20002614	AW0142	Zani Ranch - Location #6	Soledad	159	0	ROW	Lettuce, Leaf	Broccoli	Peas		2
20002610	AW0142	Henry Guidotti Ranch - Location #2	Soledad	273	0	ROW, VINEYARD	Broccoli	Peas	Lettuce, Head		2
20001078	AW0163	Home Ranch	San Juan Bautista	105		ROW	Celery	Apple	Lettuce, Head		2
20001093	AW0163	Kennedy	Watsonville	0	0	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20001077	AW0163	Porter	Watsonville	97	0	ROW	Cauliflower	Lettuce, Head	Broccoli		2
20001091	AW0163	Struve	Watsonville	64	0	ROW	Lettuce, Head	Broccoli	Celery		2
20001089	AW0163	Wilder	Watsonville	0	0	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf		2
20001088	AW0163	McGowan	Watsonville	114	60	ROW	Broccoli	Lettuce, Head	Celery		2
20001102	AW0163	Porter/Pajaro	Watsonville	173	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		2
20001099	AW0163	DelPiero	Watsonville	38	0	ROW	Lettuce, Leaf	Lettuce, Head	Cauliflower		2
20001082	AW0163	Resetar	San Juan Bautista	90	45	ROW	Celery	Lettuce, Leaf	Pepper, Fruiting		2
20007195	AW0180	Donovan	Santa Maria	165	165	ROW	Strawberry				2
20007197	AW0180	Airport Ranch	Orcutt	140	140	ROW	Strawberry				2
20007203	AW0180	Dominion Ranch	Santa Maria	135	135	ROW	Strawberry				2
20007200	AW0180	Stowell Ranch	Santa Maria	114	114	ROW	Strawberry				2
20007205	AW0180	White Hills	Orcutt	74	74	ROW	Strawberry				2
20007207	AW0180	Priesker Ranch	Santa Maria	25	25	ROW	Strawberry				2
20007204	AW0180	Ray Rd, Ranch	Santa Maria	55	55	ROW	Strawberry				2
20007194	AW0180	John Ranch	Santa Maria	200	200	ROW	Strawberry				2
20007201	AW0180	Rosemary Ranch	Santa Maria	358	358	ROW	Strawberry	Carrot			2
20007637	AW0187	INNOVATIVE PRODUCE, INC. / RANCH 02	SANTA MARIA	74	70	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		2
20007650	AW0187	INNOVATIVE PRODUCE, INC. / RANCH 07	SANTA MARIA	54	54	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		2
20007655	AW0187	INNOVATIVE PRODUCE, INC. / RANCH 13	SANTA MARIA	73	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		2
20007651	AW0187	INNOVATIVE PRODUCE, INC. / RANCH 08	SANTA MARIA	27	27	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		2
20007647	AW0187	INNOVATIVE PRODUCE, INC. / RANCH 06/16	SANTA MARIA	120	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		2
20007645	AW0187	INNOVATIVE PRODUCE, INC. / RANCH 05	SANTA MARIA	38	38	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		2
20007656	AW0187	INNOVATIVE PRODUCE, INC. / RANCH 14	SANTA MARIA	110	110	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		2
20007641	AW0187	INNOVATIVE PRODUCE, INC./ RANCH 03	SANTA MARIA	123	123	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		2
20007652	AW0187	INNOVATIVE PRODUCE, INC. / RANCH 09	SANTA MARIA	134	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		2
20007627	AW0187	INNOVATIVE PRODUCE, INC. / RANCH 01	SANTA MARIA	131	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		2
20007643	AW0187	INNOVATIVE PRODUCE, INC. / RANCH 04	SANTA MARIA	177	177	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		2
20007654	AW0187	INNOVATIVE PRODUCE, INC. / RANCH 12	SANTA MARIA	99	99	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		2
20005401	AW0189	Salinas 2	Salinas	20	16	NURSERY, GREENHOUSE					2
20002868	AW0198	Villa Pacifica Ranch	Cayucos	46	0	ORCHARD	Avocado	Citrus		CHLORPYRIFOS	2
20004402	AW0201	Happe Flowers	Carpinteria	8	0	GREENHOUSE					2
20001930	AW0204	Home Ranch	Salinas	118	0	ROW	Lettuce, Head	Broccoli	Peas	DIAZINON, CHLORPYRIFOS	2
20001929	AW0204	Walters Ranch	Salinas	177.2	0	ROW	Lettuce, Head	Broccoli	Peas	DIAZINON, CHLORPYRIFOS	2
20001931	AW0204	Bardin Ranch	Salinas	172.3	84.3	ROW	Lettuce, Head	Broccoli	Peas	DIAZINON, CHLORPYRIFOS	2
20001926	AW0204	Waters Ranch	Salinas	94.9	0	ROW	Broccoli	Lettuce, Head	Peas	DIAZINON, CHLORPYRIFOS	2
20007284	AW0219	Takii Home	Salinas	13.7	13.7	ROW, GREENHOUSE	Other				2
20002750	AW0221	Giacomazzi	Greenfield	72	0	ROW	Lettuce, Head	Bean, Dried	Tomato	CHLORPYRIFOS	2
20002752	AW0221	Bingaman	Greenfield	262	0	ROW	Bean, Dried	Lettuce, Head	Tomato	CHLORPYRIFOS	2
20002749	AW0221	Zanetta	Greenfield	117.5	0	ROW	Lettuce, Head	Bean, Dried	Tomato	CHLORPYRIFOS	2
20002748	AW0221	Pasque	Greenfield	184	0	ROW	Lettuce, Head	Bean, Dried	Tomato	CHLORPYRIFOS	2
20002751	AW0221	Cox	Greenfield	107.67	0	ROW	Bean, Dried	Lettuce, Head	Tomato	CHLORPYRIFOS	2
20004678	AW0222	Via Real	Carpinteria	6	0	GREENHOUSE					2
20000979	AW0232	Pista Ranch	Salinas	43	43	ROW	Strawberry				2
20008107	AW0232	Dayton	Salinas	213	213	ROW	Bean, Unspecified	Strawberry	Lettuce, Leaf		2
20001733	AW0232	Yuki	Salinas	107	107	ROW	Bean, Unspecified	Lettuce, Head	Lettuce, Leaf		2

20001732	AW0232	Lucky Strike	salinas	54		ROW	Bean, Unspecified	Lettuce, Head	Lettuce, Leaf		2
20001731	AW0232	Kondo-Lee	Salinas	206	0	ROW	Lettuce, Head	Lettuce, Leaf	Bean, Unspecified		2
20001730	AW0232	Green Valley	Salinas	49	49	ROW	Lettuce, Head	Lettuce, Leaf	Bean, Unspecified		2
20007188	AW0234	Goodfield Ranch	Carpinteria	2	0	ORCHARD	Avocado				2
20012382	AW0236	MSF R-5	Santa Maria	167	142.5	ROW	Broccoli				2
20011462	AW0236	MSF R-21	Nipomo	51	0	ROW	Strawberry				2
20007625	AW0236	MSF R-12	Santa Maria	210	0	ROW	Broccoli	Strawberry			2
20003912	AW0236	MSF R-8	Santa Maria	140	0	ROW, NURSERY	Broccoli	Strawberry			2
20011282	AW0236	MSF R-30	Nipomo	70.6	0	ROW	Strawberry				2
20003883	AW0236	MSF R-4	Santa Maria	134.5	0	ROW	Broccoli				2
20003924	AW0236	MSF R-10	Santa Maria	193	193	ROW	Broccoli				2
20008722	AW0244	Johannes Flowers	Carpinteria	47		ORCHARD					2
20004567	AW0244	international floral	carpinteria	26	0	GREENHOUSE				DIAZINON, CHLORPYRIFOS	2
20003556	AW0249	Peter Eugene and Nancy Lou Mehlschau Family Trust	Nipomo	189	0	ORCHARD	Lemon	Avocado		CHLORPYRIFOS	2
20004682	AW0261	FB Ranch 11	Nipomo	325.32	325.32	ROW	Broccoli	Lettuce, Head	Cauliflower		2
20004684	AW0261	FB Ranch 9	Guadalupe	75.74	75.74	ROW	Lettuce, Head	Broccoli	Cauliflower		2
20004675	AW0261	FB Ranch #1	Nipomo	394.58	394.58	ROW	Broccoli	Lettuce, Head	Cauliflower		2
20001534	AW0262	Canyon Ranch	Shandon	370	0	ROW, VINEYARD	Onion, Dry	Tomato	Carrot		2
20000794	AW0284	Tomatillo	Nipomo	18	0	ROW	Strawberry	Strawberry	Strawberry	CHLORPYRIFOS	2
20000799	AW0284	Bonita	Nipomo	24		ROW	Strawberry	Strawberry	Strawberry	CHLORPYRIFOS	2
20000798	AW0284	Iglesia	Nipomo	12		ROW	Strawberry	Strawberry	Strawberry	CHLORPYRIFOS	2
20000797	AW0284	Palmo #1	Nipomo	12	0	ROW	Strawberry	Strawberry	Strawberry	CHLORPYRIFOS	2
20000796	AW0284	Palma#2	Nipomo	11.5	0	ROW	Strawberry	Strawberry	Strawberry	CHLORPYRIFOS	2
20007192	AW0298	Rancho La Vina/leased organic	Lompoc	35	0	ROW	Tomato	Peas	Squash, Summer		2
20007193	AW0298	Rancho La Vina/leased conventional	Lompoc	86	0	ROW	Bean, Dried				2
20004844	AW0300	F & G VINEYARD	SOLEDAD	200	0	VINEYARD	Mustard				2
20000702	AW0310	Pura Ranch	Gonzales	171.8	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	CHLORPYRIFOS	2
20000704	AW0310	Breschini	Gonzales	194.4	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	CHLORPYRIFOS	2
20000705	AW0310	Pedrazzi	Gonzales	148.1	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	CHLORPYRIFOS	2
20007594	AW0321	Coslett Ranch	Goleta	20	20	ORCHARD	Avocado			DIAZINON	2
20000682	AW0329	same	Hollister	69	0	ROW	Corn, Human Con.	Onion, Dry	Pepper, Fruiting		2
20001526	AW0351	Van Wingerden Ranch Baba 2	Carpinteria	18		ORCHARD, GREENHOUSE	Avocado	Other			2
20001524	AW0351	Van Wingerden Ranch KM	Carpinteria	7		GREENHOUSE					2
20000882	AW0362	Stanley Park Ranch Inc	Carpinteria	35	0	ORCHARD	Avocado				2
20004285	AW0370	Ruffoni Ranch	Santa maria	105	105	ROW	Strawberry				2
20001379	AW0378	Orcutt	Salinas	177.5		ROW	Lettuce, Head	Broccoli	Celery		2
20001269	AW0378	Hardin Ranch	Salinas	243.4	0	ROW	Broccoli	Lettuce, Head	Celery	DIAZINON	2
20001239	AW0378	Bungard Ranch	Salinas	239.2	0	ROW	Broccoli	Lettuce, Head	Celery	DIAZINON	2
20001229	AW0378	Spreckles Ranch	Spreckles Blvd	193.5	0	ROW	Lettuce, Head	Celery	Broccoli	DIAZINON	2
20001264	AW0378	Teraji	Salinas	15	0	ROW	Lettuce, Head	Broccoli	Cauliflower	DIAZINON	2
20001263	AW0378	Rianda Ranch	Salinas	15	0	ROW	Lettuce, Head	Broccoli	Celery	DIAZINON	2
20001248	AW0378	Brazil	Salinas	8	0	ROW	Lettuce, Head	Broccoli	Celery	DIAZINON	2
20001258	AW0378	Hunter Ranch	Salinas	67.2	0	ROW	Lettuce, Head	Celery	Cauliflower	DIAZINON	2
20003930	AW0379	RANCH 19 (SINCLAIR)	SANTA MARIA	39.3	39.3	ROW	Broccoli	Cauliflower	Lettuce, Leaf	CHLORPYRIFOS	2
20003913	AW0379	RANCH 14 (GULARTE)	SANTA MARIA	126.85	126.85	ROW	Broccoli	Cauliflower	Lettuce, Leaf	CHLORPYRIFOS	2
20003933	AW0379	RANCH 20 (TOGNAZZINI)	SANTA MARIA	141.45	141.45	ROW	Broccoli	Cauliflower	Raspberry	CHLORPYRIFOS	2
20003884	AW0379	RANCH 09 (LEE)	SANTA MARIA	60.5	44	ROW	Broccoli	Cauliflower	Celery	CHLORPYRIFOS	2
20003921	AW0379	RANCH 16 (GRACIA)	SANTA MARIA	0	0	ROW	Broccoli	Cauliflower	Strawberry	CHLORPYRIFOS	2
20003907	AW0379	RANCH 12 (TRAVIS)	SANTA MARIA	59.15	59.15	ROW	Broccoli	Cauliflower	Raspberry	CHLORPYRIFOS	2
20003887	AW0379	RANCH 11 (GOODWIN)	SANTA MARIA	156.84	136.84	ROW	Broccoli	Cauliflower	Strawberry	CHLORPYRIFOS	2
20003879	AW0379	RANCH 08 (ELMERS)	SANTA MARIA	146.37	0	ROW	Cauliflower	Lettuce, Head	Lettuce, Leaf	CHLORPYRIFOS	2
20003852	AW0379	RANCH 04 (TRIGUERIO)	SANTA MARIA	220.4	220.4	ROW	Broccoli	Cauliflower	Strawberry	CHLORPYRIFOS	2
20003845	AW0379	RANCH 02 (ENOS BUSS)	SANTA MARIA	184.22	184.22	ROW	Broccoli	Cauliflower	Strawberry	CHLORPYRIFOS	2
20003919	AW0379	RANCH 15 (SILVA)	SANTA MARIA	82.42	82.42	ROW	Cauliflower	Lettuce, Leaf	Spinach	CHLORPYRIFOS	2
20011105	AW0379	RANCH 06 (COYOTE)	SANTA MARIA	120	120	ROW	Broccoli	Cauliflower	Strawberry	CHLORPYRIFOS	2
20011102	AW0379	RANCH 17 (WINEMAN)	SANTA MARIA	120	75	ROW	Broccoli	Cauliflower	Strawberry	CHLORPYRIFOS	2
20011103	AW0379	RANCH 26 (BOSTER)	SANTA MARIA	58	58	ROW	Broccoli	Cauliflower	Strawberry	CHLORPYRIFOS	2
20011104	AW0379	RANCH 25 (MAIN STREET)	SANTA MARIA	61.5	61.5	ROW	Broccoli	Cauliflower	Strawberry	CHLORPYRIFOS	2
20011682	AW0379	RANCH 01 (HOMEPLACE)	SANTA MARIA	216.84	216.84	ROW	Broccoli	Cauliflower	Spinach		2
20008535	AW0385	Christopher Vineyard	Morgan Hill	1.4	0	VINEYARD					2
20002542	AW0395	Ernie Oliver Ranch	Arroyo Grande	38		ROW	Cabbage	Celery	Broccoli	DIAZINON, CHLORPYRIFOS	2
20002546	AW0395	Fuchiwaki Ranch	Arroyo Grande	22		ROW	Celery	Cabbage	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20002553	AW0395	Passion Ranch	Arroyo Grande	54		ROW	Broccoli	Celery	Cabbage	DIAZINON, CHLORPYRIFOS	2

20002547	AW0395	Hilo's Ranch	Arroyo Grande	1.5		ROW	Broccoli	Cabbage	Celery	DIAZINON, CHLORPYRIFOS	2
20002545	AW0395	Bello Ranch	Arroyo Grande	16.5		ROW	Broccoli	Celery	Cabbage	DIAZINON	2
20002552	AW0395	Rutiz Ranch	Arroyo Grande	11		ROW	Celery	Broccoli	Lettuce, Head	DIAZINON, CHLORPYRIFOS	2
20002551	AW0395	Van Velson	Arroyo Grande	5.2		ROW	Broccoli	Cabbage	Celery	DIAZINON, CHLORPYRIFOS	2
20002549	AW0395	Switch Ranch	Arroyo Grande	2.7		ROW	Broccoli	Celery	Cabbage	DIAZINON, CHLORPYRIFOS	2
20002548	AW0395	Hilo Chandler Ranch	Arroyo Grande	6		ROW	Broccoli	Lettuce, Leaf	Cabbage	DIAZINON, CHLORPYRIFOS	2
20002561	AW0395	Silvera Ranch	Arroyo Grande	25		ROW	Broccoli	Celery	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20002558	AW0395	Phelan Ranch	Arroyo Grande	34		ROW	Broccoli	Celery	Lettuce, Head	DIAZINON, CHLORPYRIFOS	2
20002550	AW0395	Oliver Ranch	Arroyo Grande	32		ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	DIAZINON, CHLORPYRIFOS	2
20002544	AW0395	Mari's Ranch	Arroyo Grande	12		ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	DIAZINON, CHLORPYRIFOS	2
20002540	AW0395	Home Ranch	Arroyo Grande	40		ROW	Broccoli	Lettuce, Head	Cabbage	DIAZINON, CHLORPYRIFOS	2
20002541	AW0395	Charlies Ranch	Arroyo Grande	23		ROW	Celery	Lettuce, Leaf	Broccoli	DIAZINON, CHLORPYRIFOS	2
20007139	AW0396	Yoshi Takahashi	Carpinteria	4	0	ORCHARD					2
20002270	AW0397	Rancho San Simeon LLC	Cambria	12	0	ROW	Peas				2
20003171	AW0399	Grey Ranch	Shandon	90	0	ROW	Lettuce, Leaf	Other			2
20000502	AW0400	Wolff Vineyards	San Luis Obispo	55	0	VINEYARD	Grapes, Wine				2
20002624	AW0407	RANCH #7	SANTA MARIA	100	100	ROW	Strawberry				2
20002622	AW0407	RANCH #2	SANTA MARIA	175	175	ROW	Strawberry				2
20007712	AW0416	Via Real Flowers	Carpinteria, Ca	4		NURSERY					2
20004830	AW0426	Orchids Royale	Carpinteria	30	0	ORCHARD, GREENHOUSE	Avocado	Other			2
20001903	AW0427	Glen Annie Ranch #1	Goleta	78		ORCHARD	Avocado	Lemon			2
20004689	AW0449	Canyon Ranch	Carpinteria	44	44	ORCHARD	Avocado	Citrus			2
20002420	AW0459	Winehiill ranch and Vineyard	Paso Robles	27	0	VINEYARD				DIAZINON, CHLORPYRIFOS	2
20004284	AW0471	Smith	Salinas	139.2	139.2	ROW	Broccoli	Lettuce, Head	Cauliflower	DIAZINON, CHLORPYRIFOS	2
20004269	AW0471	Moffit	Salinas	141.4	141.4	ROW	Broccoli	Lettuce, Head	Cauliflower	DIAZINON, CHLORPYRIFOS	2
20004265	AW0471	Bondesen	Salinas	88.8	88.8	ROW	Broccoli	Lettuce, Head	Cauliflower	DIAZINON, CHLORPYRIFOS	2
20004155	AW0471	Harden	Salinas	62.7	62.7	ROW	Broccoli	Lettuce, Head	Cauliflower	DIAZINON, CHLORPYRIFOS	2
20004289	AW0471	Struby	Salinas	85.7	85.7	ROW	Broccoli	Lettuce, Head	Celery	DIAZINON, CHLORPYRIFOS	2
20004156	AW0471	Juanita	Salinas	248	164	ROW	Broccoli	Lettuce, Head	Celery	DIAZINON, CHLORPYRIFOS	2
20004277	AW0471	Mortensen	Salinas	85.4	85.4	ROW	Broccoli	Lettuce, Head	Cauliflower	DIAZINON, CHLORPYRIFOS	2
20004072	AW0471	Violini	Salinas	130.9	0	ROW	Broccoli	Lettuce, Head	Celery	DIAZINON, CHLORPYRIFOS	2
20004306	AW0471	W & S	Salinas	107.3	107.3	ROW	Broccoli	Lettuce, Head	Cauliflower	DIAZINON, CHLORPYRIFOS	2
20004282	AW0471	Musante	Salinas	96.8	85.8	ROW	Broccoli	Lettuce, Head	Celery	DIAZINON, CHLORPYRIFOS	2
20005005	AW0481	Botelho Ranch	Hollister	120		ROW	Lettuce, Leaf	Tomato	Parsley		2
20005119	AW0481	Santa Ana Ranch	Hollister	101.5		ROW	Tomato	Lettuce, Leaf	Other		2
20004979	AW0481	Borelli Ranch	Hollister	180	0	ROW	Tomato	Lettuce, Leaf	Other		2
20005097	AW0481	Lomanto Ranch	Hollister	92		ROW	Onion, Dry	Tomato	Other		2
20005153	AW0481	Weatherly Ranch	Hollister	20		ROW	Tomato	Lettuce, Leaf	Other		2
20005191	AW0481	Fehlman Ranch	Hollister	300		ROW	Tomato	Onion, Dry	Other		2
20005215	AW0499	Duncan	salinas	162	30	ROW	Strawberry				2
20003250	AW0504	BARCELLOS	SALINAS	145	145	ROW	Broccoli	Lettuce, Leaf	Spinach	CHLORPYRIFOS	2
20003246	AW0504	SILACCI	SALINAS	311	311	ROW	Broccoli	Lettuce, Leaf	Strawberry	CHLORPYRIFOS	2
20003254	AW0504	BRAZIL	SALINAS	316.45	316.45	ROW	Broccoli	Lettuce, Leaf	Strawberry	CHLORPYRIFOS	2
20003255	AW0504	OLD STAGE	SALINAS	76	76	ROW	Strawberry	Lettuce, Leaf			2
20003256	AW0504	OLD STAGE	SALINAS	65	65	ROW	Strawberry	Lettuce, Leaf			2
20001565	AW0508	Kuramura Nursery	Salinas	3.38	0	NURSERY					2
20007798	AW0544	Westland Floral Compnay, Inc.	Carpinteria	59	0	NURSERY, ORCHARD, GREENHOUSE	Avocado	Other		CHLORPYRIFOS	2
20010462	AW0547	CRANFORD RANCH	SALINAS	34.2	34.2	ROW	Lettuce, Head	Broccoli	Cauliflower		2
20010482	AW0547	MARTELLA HOME RANCH	SALINAS	86.1	0	ROW	Lettuce, Head	Broccoli	Cauliflower		2
20010483	AW0547	MARTELLA BORDGES RANCH	SALINAS	148.3	148.3	ROW	Lettuce, Head	Cauliflower	Broccoli		2
20007123	AW0547	VIERRA RCH	SALINAS	100.3	100.3	ROW	Cauliflower	Broccoli	Lettuce, Head		2
20008423	AW0550	Boronda Ranch 15	Salinas	43.7	43.7	ROW	Strawberry				2
20002583	AW0550	Cranford	Hollister	40	40	ROW	Lettuce, Leaf	Mustard	Spinach		2
20002582	AW0550	Halperin	Hollister	170.7	170.7	ROW	Lettuce, Leaf	Mustard	Spinach		2
20002594	AW0550	ByPass	Hollister	144.2	144.2	ROW	Lettuce, Leaf	Mustard	Spinach		2
20002589	AW0550	Herbert	Hollister	202.7	202.7	ROW	Lettuce, Leaf	Mustard	Spinach		2
20002588	AW0550	Coke	Hollister	153.75	153.75	ROW	Lettuce, Leaf	Mustard	Spinach		2
20002597	AW0550	McCloskey	Hollister	182.2	182.2	ROW	Lettuce, Leaf	Mustard	Spinach		2
20002585	AW0550	Home	Gilroy	174.4	174.4	ROW	Lettuce, Leaf	Mustard	Spinach		2
20002587	AW0550	Sabbatini	Hollister	180	180	ROW	Other	Other	Other		2
20012902	AW0550	Spanish Flats	Paicines	66.9	66.9	ROW	Lettuce, Leaf	Broccoli	Cauliflower		2
20008444	AW0550	Duflock Ranch 5	San Ardo	242.5	242.5	ROW	Lettuce, Leaf	Broccoli	Lettuce, Head		2
20008438	AW0550	Swale Ranch 13	Chualar	152.2	152.2	ROW	Beet	Broccoli	Kale		2

20008424	AW0550	Hansen Ranch 6	Chualar	61.4	61.4	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20008443	AW0550	Turri-Swale Ranch 8	Chualar	203.5	203.5	ROW	Beet	Broccoli	Lettuce, Head		2
20008006	AW0550	Echenique Ranch 4	San Lucas	440	440	ROW	Broccoli	Lettuce, Leaf	Spinach		2
20008426	AW0550	Romie Ranch 9	Chualar	62.5	62.5	ROW	Broccoli	Lettuce, Leaf	Lettuce, Head		2
20001242	AW0559	Zanchi Ranch	New Cuyama	400.79		ROW	Carrot	Broccoli	Lettuce, Leaf		2
20008922	AW0568	Dart Farms	Carpinteria	2	2	ORCHARD	Avocado				2
20009562	AW0600	Tomasini Ranch	Soledad	72.5	0	ROW	Broccoli	Bean, Dried	Carrot		2
20009563	AW0600	River Ranch	Soledad	133	0	ROW	Broccoli	Bean, Dried	Carrot		2
20001458	AW0624	Site #2 Goldsmith	Gilroy	6	0	NURSERY					2
20004982	AW0626	Santa Barbara Orchid Estate	Santa Barbara	1.8	0	NURSERY, GREENHOUSE				CHLORPYRIFOS	2
20004010	AW0641	La Barge Vineyard	Lompoc	5	0	VINEYARD					2
20004111	AW0649	ENVAR	WATSONVILLE	37		ROW	Raspberry				2
20004135	AW0649	RADIN	AROMAS	55		ROW	Raspberry				2
20004038	AW0649	FLATS	WATSONVILLE	52		ROW	Raspberry				2
20004944	AW0654	Dayton Ranch	salinas	210	210	ROW	Strawberry	Lettuce, Head	Lettuce, Leaf		2
20004177	AW0670	Ocean Cliff	Santa Cruz	164	164	ROW	Brussel Sprout	Leek			2
20004181	AW0670	Bargiacchi Ranch	Santa Cruz	73.25	73.25	ROW	Brussel Sprout	Leek			2
20006180	AW0678	B & H Flowers, Inc.	Carpinteria	20	0	ROW, GREENHOUSE	Other				2
20006200	AW0678	Paradise Ranch	Carpinteria	50		ORCHARD	Avocado				2
20004776	AW0679	Springfield Nursery Inc.	Moss Landing	5	5	NURSERY					2
20012502	AW0681	7a ANNUAL	Gonzales	370.8	0	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20012506	AW0681	Ranch 26 North	King City	258.7	0	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20013062	AW0681	Ranch 11 West	Salinas	193.9	0	ROW	Broccoli	Cauliflower	Lettuce, Leaf	CHLORPYRIFOS	2
20013063	AW0681	Ranch 11 East	Salinas	369.4	0	ROW	Broccoli			CHLORPYRIFOS	2
20012443	AW0681	Ranch 7 South	Gonzales	371.6	0	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20012504	AW0681	Zabala 10	Soledad	350.6	0	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20012423	AW0681	Ranch 4 South	Gonzales	129.4	0	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20012444	AW0681	Ranch 7 North	Gonzales	264.8	0	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20012465	AW0681	Ranch 22	Salinas	342	108	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20002895	AW0681	Ranch 18	Gonzales	326	0	ROW	Broccoli	Lettuce, Leaf	Other	DIAZINON, CHLORPYRIFOS	2
20002907	AW0681	Ranch 27	King City	455	0	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20002872	AW0681	Ranch 2	Salinas	164	0	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20002875	AW0681	Ranch 3	Salinas	150	0	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20002877	AW0681	Ranch 5	Salinas	215	78	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20002878	AW0681	Ranch 6	Salinas	454	0	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20002881	AW0681	Ranch 8	Gonzales	438	0	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20002888	AW0681	Ranch 14	Salinas	370	0	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20002893	AW0681	Ranch 17	Salinas	451	0	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20002899	AW0681	Ranch 21	Salinas	185	0	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20002897	AW0681	Ranch 19	Castoville	177	125	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20002902	AW0681	Ranch 24	Soledad	291	0	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20012464	AW0681	Bunn	Salinas	318	0	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20012462	AW0681	Fontes 12	Salinas	71.4	71.4	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20012463	AW0681	DeSerpa 12	Salinas	50.2	50.2	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20013065	AW0681	Ranch 25 West	King City	357.9	0	ROW	Broccoli	Cauliflower	Lettuce, Leaf	CHLORPYRIFOS	2
20012422	AW0681	Ranch 1 South	Salinas	438.5	0	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20012424	AW0681	Vosti 4	Gonzales	91.3	0	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20003023	AW0692	San Juan Ranch	San Juan Bautista	60	60	ROW, ORCHARD	Leek	Cucumber	Celery		2
20003025	AW0692	Santa Ana Ranch	Hollister	184	184	ROW, ORCHARD	Onion, Dry	Pepper, Fruiting	Squash		2
20004220	AW0695	RANCHO GAVILAN	HOLLISTER-GILROY	429	429	ROW	Bean, Unspecified	Tomato	Onion, Dry		2
20002661	AW0699	Bixby-Fink-Pereira Ranch	San Juan Bautista	86	0	ROW	Kale	Parsley	Other		2
20002657	AW0699	O'Donnell Ranch	San Juan Bautista	51	13	ROW	Beet	Kale	Other		2
20002665	AW0699	Silva Ranch	San Juan Bautista	121	0	ROW	Spinach	Lettuce, Leaf	Other		2
20002669	AW0699	Shrine Ranch	Chualar	424	0	ROW	Leek	Lettuce, Head	Other		2
20002659	AW0699	Prescott Ranch	San Juan Bautista	15	13	ROW	Pumpkin	Lettuce, Leaf			2
20013086	AW0699	Candlen Ranch	San Juan Bautista	85.3	0	ROW	Lettuce, Leaf				2
20013088	AW0699	Freitas Ranch	San Juan Bautista	161.4	0	ROW	Lettuce, Leaf				2
20003649	AW0704	Aromas Nursery	Aromas	5	0	NURSERY					2
20007483	AW0705	Filice Home Ranch	Hollister	341	0	ROW	Lettuce, Leaf	Spinach	Pepper, Fruiting		2
20007682	AW0705	Dassel	Hollister	91	0	ROW	Tomato	Celery	Pepper, Fruiting		2
20007786	AW0705	Villa	Hollister	66	0	ORCHARD	Other			DIAZINON	2
20007577	AW0705	Rossi/Dabo	Hollister	274	0	ROW	Celery	Wheat	Pepper, Fruiting		2
20007544	AW0705	Northeast Hollister Ranch	Hollister	457	0	ROW	Spinach	Wheat	Celery		2

20007774	AW0705	NYLAND	San Juan Bautista	269	101	ROW	Lettuce, Leaf	Spinach	Tomato		2
20001023	AW0705	NISHITA RANCH	SAN JUAN BAUTISTA CA	116	49	ROW	Tomato	Lettuce, Leaf	Pepper, Fruiting		2
20003053	AW0706	Ranch 3 - Yuki Ranch	Chualar	131	0	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20003052	AW0706	Ranch 1 - Broome Ranch Organic (Lots 44-45)	Chualar	23	0	ROW	Lettuce, Leaf	Spinach			2
20003063	AW0706	Ranch 11 - Los Coches (Silverlake)	Soledad	223	20	ROW	Broccoli	Lettuce, Leaf		DIAZINON, CHLORPYRIFOS	2
20007836	AW0708	SUNSTONE VINEYARDS & WINERY, INC	SANTA YNEZ	28	0	VINEYARD	Grapes, Wine				2
20000824	AW0712	Hambey Ranch	Salinas	23	23	ROW	Artichoke				2
20000825	AW0712	Rodgers Ranch	Salinas	7	5	ROW	Pumpkin	Squash	Corn, Human Con.		2
20000826	AW0712	Home Ranch	Salinas	202	180	ROW	Broccoli	Lettuce, Leaf	Artichoke		2
20007457	AW0712	Russell Ranch	Salinas	92	92	ROW	Broccoli	Lettuce, Leaf			2
20004065	AW0713	Clark	Greenfield	159	50	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		2
20004043	AW0713	Hess Ranch	Salinas	96	96	ROW	Lettuce, Head	Lettuce, Leaf	Strawberry		2
20004052	AW0713	Schween Ranch	Salinas	85	85	ROW	Strawberry	Lettuce, Head	Lettuce, Leaf		2
20004063	AW0713	Borchard	Chualar	145	30	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		2
20004070	AW0713	Rodgers	Salinas	116	69.8	ROW	Cauliflower	Lettuce, Head	Strawberry		2
20004068	AW0713	Handley	Greenfield	97	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		2
20004069	AW0713	Yuki	Chualar	267	26	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		2
20004048	AW0713	Pasco Ranch	Salinas	389.8	20	ROW	Lettuce, Head	Lettuce, Leaf	Cauliflower		2
20004022	AW0713	Gabilan Ranch	Salinas	205	205	ROW	Lettuce, Head	Broccoli	Lettuce, Leaf		2
20004036	AW0713	Esperanza Ranch	Salinas	124	124	ROW	Lettuce, Head	Broccoli	Lettuce, Leaf		2
20004056	AW0713	Whalebone	Salinas	128	91.5	ROW	Lettuce, Head	Lettuce, Leaf	Cauliflower		2
20004064	AW0713	Phillips	Greenfield	128	115	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		2
20001594	AW0714	Dudgeon Ranch	Soledad	57.8	0	ROW	Lettuce, Leaf	Broccoli	Cauliflower		2
20007240	aw0716	Dunne Ranch	Hollister	400	400	VINEYARD	Grapes, Wine			CHLORPYRIFOS	2
20001001	AW0726	O.M.	Hollister	2.5	0	ORCHARD	Walnut			CHLORPYRIFOS	2
20001007	AW0726	Bowden	Hollister	13	0	ORCHARD	Walnut				2
20000991	AW0726	Nancett	Hollister	7	0	ORCHARD	Walnut			CHLORPYRIFOS	2
20000999	AW0726	Home Ranch	Hollister	2.5	0	ORCHARD	Walnut			CHLORPYRIFOS	2
20000997	AW0726	Picetti	Hollister	10	0	ORCHARD	Other			CHLORPYRIFOS	2
20001688	AW0728	Nong Woo Seed America, Inc.	San Juan Bautista	30	0	ROW, GREENHOUSE	Pepper, Fruiting	Broccoli			2
20001760	AW0733	Bill Jurveich	Hollister	20	0	ORCHARD				DIAZINON	2
20007575	AW0734	Al Bonturi	Hollister	28.02	0	ORCHARD	Walnut			CHLORPYRIFOS	2
20004832	AW0738	Lucy Brown Lane	San Juan Bautista	65	65	ROW, GREENHOUSE	Lettuce, Head	Pepper, Fruiting	Onion, Green	DIAZINON	2
20005136	AW0755	Halter Ranch Vineyard	Paso Robles	250	0	VINEYARD	Leek				2
20002462	AW0757	pasquini ranch	san luis obispo	13.5	0	ROW	Peas	Squash	Tomato		2
20002463	AW0757	crowle ranch	san luis obispo	6.5	0	ROW	Bean, Dried	Squash	Tomato		2
20002229	AW0757	lowe ranch	san luis obispo	17	0	ROW	Bean, Dried	Squash			2
20007163	AW0760	Main Bolsa	Hollister	115	0	ORCHARD				DIAZINON	2
20007146	AW0760	Briggs/Bolsa Road	Hollister	101	0	ORCHARD				DIAZINON	2
20002510	AW0763	Scagliotti Farms	Hollister	81		ROW	Lettuce, Leaf	Broccoli	Onion, Dry		2
20005104	AW0765	Young	Hollister	75	60	ROW	Onion, Dry	Tomato	Pepper, Fruiting		2
20005175	AW0765	Yang	Hollister	215	100	ROW	Spinach	Lettuce, Leaf	Mustard		2
20012284	AW0765	Yuki	Hollister	118	50	ROW	Pepper, Fruiting	Wheat			2
20005144	AW0765	Lico	Hollister	90	90	ROW	Onion, Dry	Tomato	Pepper, Fruiting		2
20005079	AW0765	Machado	Gilroy	57	57	ROW	Pepper, Fruiting	Lettuce, Head	Tomato		2
20005161	AW0765	Zanger	Hollister	154	30	ORCHARD				DIAZINON	2
20004271	AW0766	Foster Ranch	Hollister	250	0	ROW	Tomato	Onion, Dry	Pepper, Fruiting		2
20004274	AW0766	Brookhollow Ranch	Hollister	120	0	ROW	Lettuce, Leaf				2
20004260	AW0766	Santa Ana Ranch	Hollister	200	0	ROW	Onion, Dry	Pepper, Fruiting	Tomato		2
20002088	AW0769	Silva Farms	Gilroy	128	128	ROW	Oat	Pepper, Fruiting			2
20008174	AW0775	Nakamura Ranch	Moss landing	30	30	ROW	Strawberry	Lettuce, Head			2
20003629	AW0775	Capurro Home Ranch	Moss Landing, CA	284	284	ROW	Strawberry	Lettuce, Head			2
20003630	AW0775	Nielson Ranch	Moss Landing, CA	81	81	ROW	Lettuce, Head	Strawberry			2
20007370	AW0783	Cienega Vineyard	Hollister	24	0	VINEYARD					2
20004752	AW0789	Rohnert	HOLLISTER	443	190	ROW	Tomato	Wheat	Onion, Dry	DIAZINON, CHLORPYRIFOS	2
20004751	AW0789	Resetar	HOLLISTER	148	0	ROW	Tomato			DIAZINON	2
20004750	AW0789	Bolsa	HOLLISTER	107	0	ROW	Collard	Onion, Dry	Tomato	DIAZINON, CHLORPYRIFOS	2
20004988	AW0795	Pietra Santa Winery	Hollister	155		ROW, VINEYARD, ORCHARD	Grapes, Wine	Olive		DIAZINON, CHLORPYRIFOS	2
20002671	AW0796	SJBG	San Juan Bautista	25		ROW	Other	Other	Other		2
20002674	AW0796	Mac	San Juan Bautista	100		ROW	Other	Other	Other		2
20007437	AW0797	Caravella Ranch	Hollister	70	0	ROW	Pepper, Fruiting				2
20010782	AW0801	RANCH 10 PLOT 1 ORCHARD ROAD`	NIPOMO	60	60	ROW	Broccoli				2
20004493	AW0813	Turri Ranch, Parcel 3	San Luis Obispo	50	0	ROW	Peas	Cauliflower	Other	CHLORPYRIFOS	2

20004554	AW0813	Turri Ranch Parcel 1 & 2	San Luis Obispo	120	0	ROW	Peas	Chinese Cabbage	Other	CHLORPYRIFOS	2
20008025	aw0818	Clevenger Ranch Vineyard	Paso Robles	80		ROW, VINEYARD	Grapes, Wine			CHLORPYRIFOS	2
20003516	AW0824	Galbraith Ranch	San Miguel	94		ROW	Oat	Wheat	Barley	CHLORPYRIFOS	2
20007042	aw0829	1700 glen annie rd	goleta	5	0	ORCHARD					2
20003384	AW0832	1040 N. Thompson	Nipomo	14	0	GREENHOUSE					2
20001588	AW0853	Chadmark Farms	Paso Robles	27	0	ROW, VINEYARD, ORCHARD	Corn, Human Con.	Squash, Summer		DIAZINON	2
20003110	AW0855	Brown Monterey Road Ranch	Paso Robles	7	0	ROW	Onion, Dry	Oat	Other		2
20002020	AW0863	Douglas Bathe	Arroyo Grande	9	0	ORCHARD				CHLORPYRIFOS	2
20002687	AW0871	Cross Creek Ranch	San Luis Obispo	95	0	ORCHARD	Lemon	Citrus		CHLORPYRIFOS	2
20007499	AW0877	Los Padres Orchid Company	Carpinteria	0.75	0.75	NURSERY, GREENHOUSE					2
20001685	AW0881	Arroyo Grande Research Station	Arroyo Grande	16	0	ROW, GREENHOUSE	Broccoli			DIAZINON, CHLORPYRIFOS	2
20000580	AW0885	George Dana	Nipomo, CA	47	0	ORCHARD				CHLORPYRIFOS	2
20002122	AW0890	Parrish Vineyards	Creston	52	0	ROW, VINEYARD	Grapes, Wine	Onion, Dry			2
20007917	AW0899	R.C. Manuel Farms	Morro Bay	4	0	ROW	Pepper, Fruiting	Squash	Bean, Unspecified		2
20001327	AW0908	Gisler Ranch	Arroyo Grande	109.99	0	ROW	Lettuce, Leaf	Pepper, Fruiting	Brussel Sprout		2
20001317	AW0908	Biddle Ranch	Arroyo Grande	114.06	0	ROW	Pepper, Fruiting	Lettuce, Leaf	Brussel Sprout		2
20001321	AW0908	Hatano Ranch	Arroyo Grande	25.85	11	ROW	Lettuce, Leaf	Pepper, Fruiting	Brussel Sprout		2
20001336	AW0908	Finney Ranch	Arroyo Grande	50.46	50.46	ROW	Lettuce, Leaf	Pepper, Fruiting	Brussel Sprout		2
20001320	AW0908	Adobe Ranch	Arroyo Grande	86.72	8.27	ROW	Brussel Sprout	Pepper, Fruiting	Lettuce, Leaf		2
20001323	AW0908	Bello Ranch	Arroyo Grande	55.28	0	ROW	Lettuce, Leaf	Pepper, Fruiting	Brussel Sprout		2
20005580	AW0932	Williams Farm	San Luis Obispo	9	0	NURSERY					2
20000858	AW0942	Fitz-Gerald Ranch	Nipomo	43.5	0	ORCHARD					2
20001353	AW0983	high school ranch	nipomo	80	0	ROW	Peas				2
20009223	AW0983	church	nipomo	30	0	ROW	Peas				2
20003480	AW0984	ranch 3/ Fox	Nipomo	85.5	85.5	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20003488	AW0984	ranch 5/ Sunnybrook	Nipomo	55	25	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf		2
20003499	AW0984	ranch 8/ Tognazzini	Guadalupe	104.5	104.5	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20003506	AW0984	ranch 11/Todos Santos	Los Alomos	139.2	0	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20003493	AW0984	ranch 6/Riverside	Nipomo	72.6	56.9	ROW	Cauliflower	Lettuce, Leaf			2
20003467	AW0984	ranch 2/ Mendoza	Nipomo	60	60	ROW	Cauliflower	Lettuce, Head	Celery		2
20003507	AW0984	ranch 12/ Arrellaanes north	Orcutt	124.7	124.7	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf		2
20003508	AW0984	ranch 14/ Arrellanes south	Orcutt	123	123	ROW	Broccoli	Lettuce, Head			2
20003504	AW0984	ranch 9/ Laguna	Nipomo	165.7	0	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20003505	AW0984	ranch 10/ Silva	Santa Maria	124	112	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20003497	AW0984	ranch 7/ Johnson	Nipomo	170.4	131.7	ROW	Broccoli	Cauliflower	Lettuce, Leaf		2
20003442	AW0998	River Edge Farms / Ranch # 6	Santa maria	75	0	ROW	Strawberry				2
20007983	AW0998	River Edge Farms/ Ranch #4	santa maria	79	0	ROW	Strawberry				2
20003438	AW0998	River Edge Farms/ Ranch # 5	Santa maria	168	110	ROW	Broccoli	Cauliflower	Celery		2
20003440	AW0998	River Edge Farms/ Ranch # 1	Santa Maria	155	155	ROW	Broccoli	Cauliflower	Squash		2
20001428	AW1001	RDH Esperanza	Carpinteria	55	0	ORCHARD	Avocado				2
20001417	AW1001	Cate Ranch	Carpinteria	16	0	ORCHARD	Avocado				2
20001406	AW1001	La Rosa De Castilla	Carpinteria	10	0	ORCHARD	Avocado				2
20004492	AW1002	Santa Maria	Nipomo	6.1	0	NURSERY					2
20003719	AW1008	Okui farms Ranch 2	Nipomo	180	0	ROW	Broccoli	Lettuce, Head	Chinese Cabbage		2
20004883	AW1014	Clearwater Color Nursery	Los Osos	4.5	0	NURSERY				CHLORPYRIFOS	2
20003666	AW1022	C&M Nursery	Nipomo	21	0	NURSERY, GREENHOUSE	Avocado	Citrus			2
20002226	AW1041	MARGETT VINEYARDS	PASO ROBLES	37	0	VINEYARD	Grapes, Wine			DIAZINON, CHLORPYRIFOS	2
20004092	AW1043	Ranch #14 - Plot 07	Los Osos	30		ROW	Broccoli	Lettuce, Leaf	Chinese Cabbage		2
20004131	AW1043	Ranch #11 - AB Turri Company	Los Osos	63	45	ROW	Broccoli	Celery	Lettuce, Leaf		2
20004116	AW1043	Ranch #4,5,6,7, and 8 - Highland Ranches / Warden	Los Osos	152	0	ROW	Broccoli	Chinese Cabbage	Lettuce, Leaf		2
20004108	AW1043	Ranch #2 and #14 - Eto Ranch	Los Osos	124	35	ROW	Broccoli	Chinese Cabbage	Lettuce, Leaf		2
20004102	AW1043	Ranch #1 - Dohi Ranch	Arroyo Grande	55	55	ROW	Broccoli	Chinese Cabbage	Lettuce, Leaf		2
20003703	AW1054	Halcyon	Arroyo Grande	28	0	ROW	Broccoli	Carrot	Strawberry		2
20002409	AW1055	2 Peas in a Pod	Arroyo Grande	8	0	ROW	Broccoli	Cauliflower	Peas		2
20007385	AW1072	Guggia Farms	Santa Maria	391.2	391.2	ROW	Broccoli			CHLORPYRIFOS	2
20004442	AW1084	Ranch 4	Nipomo	60	40	ROW	Broccoli				2
20004425	AW1084	Ranch 1	Santa Maria	50	50	ROW	Broccoli				2
20004444	AW1084	Ranch 5	Nipomo	72	60	ROW	Broccoli				2
20004451	AW1084	Ranch 9	Nipomo	50	0	ROW	Broccoli				2
20004434	AW1084	Ranch 3	Santa Maria	90	90	ROW	Broccoli				2
20004438	AW1084	Ranch 6	Santa Maria	140	75	ROW	Broccoli				2
20000836	AW1085	Ranch 2	Arroyo Grande	9	9	ROW	Chinese Cabbage	Endive	Kale		2
20000837	AW1085	Ranch 3	Arroyo Grande	41.5	41.5	ROW	Chinese Cabbage	Endive	Kale		2

20000835	AW1085	Ranch 1	Arroyo Grande	9	9	ROW	Chinese Cabbage	Endive	Kale		2
20000840	AW1085	Ranch 6	Los Osos	48	48	ROW	Chinese Cabbage	Endive	Kale		2
20000838	AW1085	Ranch 4	Arroyo Grande	25	25	ROW	Chinese Cabbage	Endive	Kale		2
20000839	AW1085	Ranch 5	Arroyo Grande	27	27	ROW	Chinese Cabbage	Endive	Kale		2
20004488	AW1099	Windy Creek Ranch	San Luis Obispo	2.5	0	GREENHOUSE					2
20000561	AW1112	Bartleson Ranch	Arroyo grande	247.1	0	ORCHARD					2
20001308	AW1115	Mills Farms Ranch #4	Nipomo	124	0	ROW	Broccoli				2
20001304	AW1115	Mills Farms Ranch #1	Nipomo	119	66	ROW	Broccoli				2
20001306	AW1115	Mills Farms Ranch #2	Nipomo	106	106	ROW	Broccoli				2
20004661	AW1119	Highland Ranch	San Luis Obispo	45	0	ROW	Squash, Summer	Cauliflower			2
20012582	AW1130	Dalido Ranch	san Luis Obispo	100	100	ROW	Lettuce, Head	Pepper, Fruiting	Chinese Cabbage		2
20003981	AW1137	Morro Bay	Morro Bay	135	0	ROW	Chinese Cabbage	Lettuce, Leaf	Broccoli	DIAZINON, CHLORPYRIFOS	2
20003973	AW1137	Huausna	Arroyo Grande	92	0	ROW	Chinese Cabbage	Lettuce, Leaf	Broccoli	DIAZINON, CHLORPYRIFOS	2
20003966	AW1137	Arroyo Grande	Arroyo Grande	87	0	ROW	Chinese Cabbage	Lettuce, Leaf	Strawberry	DIAZINON, CHLORPYRIFOS	2
20011202	AW1137	San Luis Obispo	San Luis Obispo	26	0	ROW	Broccoli	Chinese Cabbage	Lettuce, Leaf		2
20003204	AW1145	Ranch 17	Arroyo Grande	122	122	ROW	Chinese Cabbage	Spinach	Lettuce, Head		2
20003276	AW1145	Ranch 27	Arroyo Grande	166	166	ROW	Chinese Cabbage	Lettuce, Leaf	Cabbage		2
20003201	AW1145	Ranch 07	Arroyo Grande	150	0	ROW	Broccoli	Celery	Lettuce, Head		2
20007474	AW1146	Ibarra Farms	arroyo grande	20	0	ROW	Lettuce, Head	Cauliflower	Cabbage		2
20004313	AW1150	Ranch #4 - Greengate	San Luis Obispo	60	0	ROW	Broccoli	Chinese Cabbage	Pepper, Fruiting		2
20004329	AW1150	Ranch #13 - Maino, Bunnell, City of San Luis Obispo	San Luis Obispo	70	0	ROW	Chinese Cabbage	Pepper, Fruiting	Tomato		2
20004307	AW1150	Ranch #1 - Christensen	San Luis Obispo	142	0	ROW	Pepper, Fruiting	Lettuce, Leaf	Chinese Cabbage		2
20004312	AW1150	Ranch #3 - Lindsey	San Luis Obispo	50	0	ROW	Pepper, Fruiting	Chinese Cabbage	Squash		2
20004316	AW1152	Meissner Farm	san luis obispo	10	0	ROW	Tomato	Squash	Lettuce, Leaf	DIAZINON	2
20004797	AW1154	Lompoc Ranch	Lompoc	150	0	ROW	Lettuce, Head	Broccoli			2
20004802	AW1154	Los Berros Ranch	Arroyo Grande	14	0	ORCHARD	Avocado				2
20007865	AW1159	Ranch 6	Guadalupe	193	193	ROW	Strawberry				2
20007860	AW1159	Ranch 4	guadalupe	146	146	ROW	Strawberry				2
20007868	AW1159	Ranch 8	Guadalupe	103	103	ROW	Strawberry				2
20005003	AW1164	Horton 1	Carpinteria	34	34	ORCHARD	Avocado				2
20005063	AW1164	Zanier Ranch	Carpinteria	21	21	ORCHARD	Avocado				2
20005056	AW1164	Gillie Orchards, LLC (used to be Thor)	Carpinteria	16	16	ORCHARD	Avocado				2
20002602	AW1167	Spring Harvest Berry	Santa Maria	130		ROW	Strawberry				2
20010023	AW1181	Phelan/Taylor (1,2,3)	Oceano	289	87	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20009983	AW1181	Franklin (8)	Arroyo Grande	60	18	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20009984	AW1181	Waller (9)	Arroyo Grande	59	18	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20009986	AW1181	E&M (10)	Arroyo Grande	56	17	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20010022	AW1181	Taylor/Siva (7)	Arroyo Grande	58	17	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20007943	AW1183	Ranch 3	santa maria	81	81	ROW	Artichoke	Broccoli	Cauliflower		2
20003669	AW1183	Ranch 2	Guadalupe	92.35	92.35	ROW	Broccoli				2
20003676	AW1183	Ranch 4	Arroyo Grande	70.25	70.25	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20003672	AW1183	Ranch 8	guadalupe	85	85	ROW	Broccoli				2
20003667	AW1183	Ranch 1	Guadalupe	52	52	ROW	Broccoli	Lettuce, Head			2
20007321	AW1188	Valley Flowers	Carpinteria	22	12	ROW, GREENHOUSE	Other	Other	Other		2
20002402	AW1189	santa ynez gardens inc.	santa ynez	5.19	5.19	NURSERY				CHLORPYRIFOS	2
20002280	AW1190	Caswell Ranch	Goleta	27	27	NURSERY, ORCHARD					2
20004247	AW1192	Edalatpour Ranch	Buellton	40	0	ROW, ORCHARD	Artichoke				2
20004342	AW1198	Pennycook	Salinas	117	117	ROW	Strawberry				2
20010603	AW1198	Maretti Minetti Ranch	Guadalupe	120	120	ROW	Strawberry				2
20010602	AW1198	Desanti Ranch	Salinas	100	100	ROW	Strawberry				2
20010605	AW1198	Airport Ranch	Santa Maria	446	446	ROW	Strawberry	Bean, Unspecified	Squash		2
20010802	AW1198	Buckley Ranch	Guadalupe	105	105	ROW	Strawberry				2
20010604	AW1198	Agro Jal - Tres Rios Ranch	Santa Maria	178	178	ROW	Strawberry				2
20008330	AW1204	43	Buellton	147	0	ROW	Bean, Dried	Broccoli			2
20008313	AW1204	14	Lompoc	125	0	ROW	Bean, Dried	Broccoli			2
20008314	AW1204	19	Lompoc	30	0	ROW	Broccoli				2
20008322	AW1204	28	Lompoc	102	0	ROW	Bean, Dried	Lettuce, Head			2
20008320	AW1204	26	Lompoc	90	0	ROW	Bean, Dried	Broccoli			2
20008321	AW1204	27	Lompoc	151	0	ROW	Lettuce, Head	Broccoli			2
20008304	AW1204	6	Buellton	158	0	ROW	Broccoli	Bean, Dried			2
20008324	AW1204	29	Lompoc	125	0	ROW	Bean, Dried	Broccoli			2
20008312	AW1204	13	Lompoc	88	0	ROW	Broccoli	Cauliflower			2
20008311	AW1204	12	Lompoc	135	0	ROW	Lettuce, Head	Bean, Dried			2

20011242	AW1204	44	Lompoc	115	0	ROW	Broccoli	Bean, Dried			2
20008327	AW1204	36	Lompoc	56	0	ROW	Bean, Dried	Broccoli			2
20008318	AW1204	24	Lompoc	66	0	ROW	Broccoli	Cauliflower			2
20008319	AW1204	25	Lompoc	136	0	ROW	Bean, Dried	Broccoli			2
20008305	AW1204	8	Buellton	150	0	ROW	Bean, Dried	Broccoli			2
20008309	AW1204	11	Lompoc	76	0	ROW	Broccoli	Lettuce, Head			2
20008310	AW1204	11-B	Lompoc	96	0	ROW	Bean, Dried	Broccoli	Lettuce, Head		2
20008315	AW1204	20	Lompoc	56	0	ROW	Broccoli				2
20005520	AW1208	R&G Land and Cattle Co.	Paicines	10	0	ORCHARD					2
20003218	AW1210	Lavagnino Ranches	SAN JUAN BAUTISTA	109	89	ROW, NURSERY	Onion, Dry	Tomato	Pumpkin		2
20008541	AW1216	Breen	San juan Batuista	10	10	ROW	Squash	Kale	Peas		2
20008544	AW1216	union	hollister	65	0	ROW	Leek	Squash	Kale		2
20007962	AW1225	Battaglia Ranch	San Martin	20	0	NURSERY					2
20003589	AW1231	Sonny LO Nursery	Gilroy	3		GREENHOUSE	Chinese Cabbage	Mustard			2
20003609	AW1233	Keith Lo Nursery	Gilroy	3	0	GREENHOUSE	Chinese Cabbage				2
20003862	AW1237	Del Monte-Furlong	Gilroy	60	0	ROW, GREENHOUSE	Bean, Dried	Peas	Pepper, Fruiting		2
20003590	AW1247	Han Qiang Kuang Nursery	San Martin	4		GREENHOUSE	Chinese Cabbage	Mustard	Spinach		2
20003113	AW1248	John Wu Nursery	Gilroy	4.5	0	NURSERY	Chinese Cabbage	Other			2
20001740	AW1250	Ranch 25 - Pata	Lompoc	90	90	ROW	Broccoli	Lettuce, Head	Cauliflower	DIAZINON	2
20001741	AW1250	Ranch 26 - Mission	Lompoc	164	164	ROW	Broccoli	Cabbage	Cauliflower	DIAZINON	2
20001738	AW1250	Ranch 19 - Pettit	Lompoc	131	131	ROW	Cabbage	Cauliflower	Broccoli	DIAZINON	2
20001737	AW1250	Ranch 8 - Facer	Lompoc	74	74	ROW	Cabbage	Cauliflower	Broccoli	DIAZINON	2
20001699	AW1250	Santa Rosa Ranch	Lompoc	109.8	173	ROW	Lettuce, Head	Broccoli	Cabbage	DIAZINON	2
20001696	AW1250	Home Ranch	Lompoc	68	77.14	ROW	Lettuce, Head	Cabbage	Cauliflower	DIAZINON	2
20001743	AW1250	Ranch 27 - Sobhani	Lompoc	40	40	ROW	Lettuce, Head	Broccoli	Cabbage	DIAZINON	2
20001723	AW1250	Ranch 18 Reynolds	Lompoc	18	18	ROW	Lettuce, Head	Spinach	Cabbage	DIAZINON	2
20001722	AW1250	Ranch 15 Sloan	Lompoc	56	56	ROW	Lettuce, Head	Celery	Spinach	DIAZINON	2
20001703	AW1250	Linneman Ranch 06	Lompoc	54.8	59	ROW	Lettuce, Head	Spinach	Cauliflower	DIAZINON	2
20001721	AW1250	Ranch 14 Signorelli	Lompoc	88	88	ROW	Lettuce, Head	Celery	Cabbage	DIAZINON	2
20001718	AW1250	Ranch 12 Marx	Lompoc	57	57	ROW	Lettuce, Head	Celery	Cabbage	DIAZINON	2
20001706	AW1250	Ranch 9 Turri	Lompoc	93	93	ROW	Lettuce, Head	Celery	Cabbage	DIAZINON	2
20001687	AW1250	Apache 21	Lompoc	205.5	205.5	ROW	Lettuce, Head	Cabbage	Broccoli	DIAZINON	2
20001715	AW1250	Ranch10 Apache	Lompoc	78	81	ROW	Broccoli	Lettuce, Head	Cauliflower	DIAZINON	2
20001719	AW1250	Ranch 13 Alexander	Lompoc	8	11	ROW	Lettuce, Head	Spinach	Celery	DIAZINON	2
20004011	AW1258	Joe Chen Nursery	Gilroy	2	2	NURSERY					2
20003050	AW1261	Embarcadero Ranch	Goleta	415	0	ORCHARD	Avocado	Lemon		CHLORPYRIFOS	2
20003612	AW1263	Meng Fong Lo Nursery	Gilroy	1	0	NURSERY, GREENHOUSE				DIAZINON	2
20000583	AW1265	Gularte Orchards	Hollister	54	0	ORCHARD					2
20003566	AW1270	Shun Yu Kuang	San Martin	10	0	NURSERY					2
20003539	AW1275	Moon Wei Tom Nursery	Gilroy	3.5	0	GREENHOUSE				DIAZINON	2
20003683	AW1281	Aira Ranch	Gilroy	17.7	0	ORCHARD				DIAZINON	2
20003948	AW1286	Mauracher Ranch Corporation	Carpinteria	42		ORCHARD	Avocado				2
20005185	AW1289	Ranch 7	Guadalupe	125	125	ROW	Lettuce, Head	Broccoli	Strawberry		2
20005151	AW1289	Ranch 2	Santa Maria	28	28	ROW	Broccoli	Lettuce, Head	Strawberry		2
20005172	AW1289	Ranch 4	Santa Maria	52	52	ROW	Broccoli	Lettuce, Head	Strawberry		2
20008575	AW1289	Ranch 12	Santa Maria	175	175	ROW	Broccoli	Lettuce, Head			2
20005123	AW1289	Ranch 1	Santa Maria	95	95	ROW	Broccoli	Lettuce, Head	Strawberry		2
20005206	AW1289	Ranch 11	Guadalupe	70	70	ROW	Strawberry				2
20005154	AW1289	Ranch 3	Santa Maria	80	80	ROW	Broccoli	Lettuce, Head			2
20005193	AW1289	Ranch 8	Guadalupe	112	112	ROW	Lettuce, Head	Strawberry	Broccoli		2
20009972	AW1290	Jorge Contreras Farming	Santa Maria	80	80	ROW	Strawberry			CHLORPYRIFOS	2
20007583	AW1291	Herrera Farming Inc.	Nipomo	111	111	ROW	Strawberry			CHLORPYRIFOS	2
20008437	AW1293	BLOSSER RANCH	SANTA MARIA	52	52	ROW	Strawberry				2
20007747	AW1302	VEGGIE-FLORA NURSERY	Buellton	74	0	ROW	Broccoli	Pepper, Fruiting	Cabbage		2
20004404	AW1304	Li Fong Farm	Gilroy	20		ROW	Chinese Cabbage			DIAZINON	2
20009484	AW1307	Home Ranch	San Martin	249	249	ROW	Pepper, Fruiting	Bean, Unspecified	Squash		2
20009483	AW1307	Center Ranch	Gilroy	95	95	ROW	Pepper, Fruiting	Squash	Bean, Unspecified		2
20009486	AW1307	Pacheco Ranch	gilroy	110	110	ROW	Bean, Unspecified	Pepper, Fruiting	Squash		2
20009485	AW1307	Airport Ranch	Hollister	200	200	ROW	Pepper, Fruiting	Bean, Unspecified	Squash		2
20003398	AW1310	Safari Harvesting & Farming	Santa Maria	182	0	ROW	Strawberry				2
20001484	AW1311	Goldsmith	Gilroy	22	3	ROW, GREENHOUSE	Other			CHLORPYRIFOS	2
20003994	AW1318	Siu Man Chiu's Nursery	san martin	4	0	GREENHOUSE	Chinese Cabbage				2
20003742	AW1320	Wen de Li	Gilroy	4	0	GREENHOUSE					2

20008032	AW1326	Furlong Ranch	Gilroy	205	205	ROW	Onion, Dry	Tomato	Other		2
20008039	AW1326	Maida Ranch	Gilroy	30	30	ROW	Tomato				2
20008045	AW1326	Norton Ranch	Gilroy	93	93	ROW	Pepper, Fruiting				2
20005331	AW1327	Sportspark	Gilroy	0	0	ROW	Wheat				2
20005321	AW1327	Hoey Ranch	Gilroy	15	0	ROW	Squash				2
20005320	AW1327	Bella Creek Ranch	Gilroy	48	0	ROW	Pepper, Fruiting	Wheat			2
20005335	AW1327	Mesa Rd South	Gilroy	48	0	ROW	Bean, Unspecified				2
20004590	AW1330	Lemos Ranch	Gilroy	54	54	ROW	Pepper, Fruiting				2
20004634	AW1330	Site 2	Gilroy	60	1	NURSERY					2
20007738	AW1340	101 Ranch	Gilroy	129	0	ROW	Bean, Dried	Corn, Human Con.	Pepper, Fruiting		2
20007733	AW1340	Kessler Ranch	San Martin	15	0	ROW	Corn, Human Con.	Pepper, Fruiting			2
20007730	AW1340	Lau Ranch	San Martin	15	0	ROW	Bean, Dried	Corn, Human Con.	Pepper, Fruiting		2
20007741	AW1340	Leavesley Ranch	Gilroy	65	0	ROW	Bean, Dried	Tomato	Pepper, Fruiting		2
20007736	AW1340	Perino	Gilroy	27	0	ROW	Corn, Human Con.	Bean, Dried	Pepper, Fruiting		2
20007722	AW1340	Marns Ranch	San Martin	72	0	ROW	Corn, Human Con.	Pepper, Fruiting	Bean, Dried		2
20007528	AW1343	East Site	Gilroy	112.2	1.21	ROW, NURSERY, GREENHOUSE	Lettuce, Head	Pepper, Fruiting	Corn, Human Con.	CHLORPYRIFOS	2
20007664	AW1343	South Site	Gilroy	0.16	0.16	GREENHOUSE			Lettuce, Head	CHLORPYRIFOS	2
20003635	AW1346	rong zhen liang	gilroy	3		GREENHOUSE	Chinese Cabbage				2
20008064	AW1349	Godfrey Ranch	Gilroy	10	0	NURSERY, ORCHARD	Citrus	Other		DIAZINON	2
20008063	AW1349	New Avenue	Gilroy	4	0	NURSERY	Citrus			DIAZINON	2
20002964	AW1350	SO. 101 RANCH	Gilroy	34	0	ROW	Bean, Dried				2
20002937	AW1350	BUENA VISTA RANCH	Gilroy	18	0	ROW	Pumpkin				2
20011084	AW1350	Old 101 Ranch - PP	San Martin	6.2		ROW	Pepper, Fruiting	Bean, Dried			2
20012883	AW1353	Salinas/Potter rd.	Salinas	5	0	NURSERY	Cauliflower	Brussel Sprout	Celery		2
20001512	AW1353	San Juan	San Juan Bautista	2	0	NURSERY, GREENHOUSE	Cauliflower	Artichoke	Lettuce, Leaf		2
20001514	AW1353	Four Seasons	Salinas	4	0	NURSERY, GREENHOUSE	Artichoke	Cauliflower	Celery		2
20007373	AW1354	Sherrie	Gilroy	2.5	0	ROW	Tomato				2
20008434	AW1357	BLOSSER RANCH	SANTA MARIA	52	52	ROW	Strawberry				2
20008431	AW1357	RIVER RANCH	SANTA MARIA	60	60	ROW	Strawberry				2
20007803	AW1361	DUTRA RANCH	SISQUOC	87	0	ROW	Strawberry	Pepper, Fruiting		DIAZINON	2
20004960	AW1363	DESTINY FARMS RANCH 3	SANTA MARIA	266.67	266.67	ROW	Broccoli	Cauliflower	Celery	CHLORPYRIFOS	2
20004845	AW1363	Destiny Farms	Los Alamos	60	60	ROW	Broccoli	Pepper, Fruiting	Cauliflower	CHLORPYRIFOS	2
20004970	AW1363	DESTINY FARMS RANCH 5	SANTA MARIA	50	50	ROW	Broccoli			CHLORPYRIFOS	2
20004973	AW1363	DESTINY FARMS RANCH 6	SANTA MARIA	67	67	ROW	Broccoli			CHLORPYRIFOS	2
20004975	AW1363	DESTINY FARMS RANCH 7	LOS ALAMOS	385	385	ROW	Broccoli	Cauliflower	Cabbage	CHLORPYRIFOS	2
20004966	AW1363	DESTINY FARMS RANCH 4	SANTA MARIA	75	75	ROW	Broccoli			CHLORPYRIFOS	2
20004954	AW1363	DESTINY FARMS RANCH 2	SANTA MARIA	42.8	42.8	ROW	Broccoli			CHLORPYRIFOS	2
20004946	AW1373	1330 BUENA VISTA	GILROY	64		ROW	Pepper, Fruiting				2
20004953	AW1373	5 COHANSEY	GILROY	38		ROW	Pepper, Fruiting				2
20001451	AW1375	Home	Gilroy	5	0	ORCHARD	Walnut			DIAZINON	2
20003249	AW1377	Hann	Morgan Hill	15	0	ORCHARD					2
20003237	AW1377	Marfia	Morgan Hill	14	0	ORCHARD					2
20003244	AW1377	Fisher	Morgan Hill	9	0	ORCHARD					2
20004133	AW1389	Marti	Santa Maria	75	75	ROW	Strawberry	Broccoli	Spinach		2
20003331	AW1391	Nojoqui Creek Farms	Gaviota	78	0	ROW, ORCHARD	Pepper, Fruiting	Squash	Cabbage		2
20004965	AW1409	Rancho Guadalupe,LLC	Santa Maria	241	241	ROW, NURSERY	Broccoli	Lettuce, Head	Celery		2
20005094	AW1409	Rancho Guadalupe,LLC	Nipomo	99	99	ROW	Broccoli	Lettuce, Head	Celery		2
20005076	AW1409	Rancho Guadalupe,LLC	Santa Maria	185	185	ROW	Broccoli	Lettuce, Head	Celery		2
20005013	AW1409	Rancho Guadalupe,LLC	Santa Maria	206	206	ROW	Broccoli	Lettuce, Head	Celery		2
20005041	AW1409	Rancho Guadalupe,LLC	Santa Maria	251	251	ROW	Broccoli	Lettuce, Head	Celery		2
20005019	AW1409	Rancho Guadalupe,LLC	Santa Maria	74	74	ROW	Broccoli	Lettuce, Head	Celery		2
20005069	AW1409	Rancho Guadalupe,LLC	Santa Maria	208	208	ROW	Broccoli	Lettuce, Head	Celery		2
20005025	AW1409	Rancho Guadalupe,LLC	Santa Maria	138	138	ROW	Broccoli	Lettuce, Head	Celery		2
20005035	AW1409	Rancho Guadalupe,LLC	Santa Maria	94	94	ROW	Broccoli	Lettuce, Head	Celery		2
20005060	AW1409	Rancho Guadalupe,LLC	Santa Maria	201	201	ROW	Broccoli	Lettuce, Head	Celery		2
20001568	AW1415	Phelps and Huff	Carpinteria	70	0	ORCHARD	Avocado				2
20007708	AW1422	Shepard Inn Ranch	Carpinteria	18.5	18.5	ROW, ORCHARD	Avocado	Avocado			2
20007640	AW1423	Ranch 7 - Buckman	LOMPOC	68.3	68.3	ROW	Artichoke	Broccoli	Lettuce, Head		2
20007622	AW1423	Ranch 1	LOMPOC	388.93	436.49	ROW	Broccoli	Artichoke	Lettuce, Head		2
20007623	AW1423	Ranch 2	LOMPOC	279.06	487.17	ROW	Broccoli	Lettuce, Head	Brussel Sprout		2
20007638	AW1423	Ranch 6 - OCD	LOMPOC	87.45	87.45	ROW	Broccoli	Artichoke	Lettuce, Head		2
20007636	AW1423	Ranch 5 - Bondietti	LOMPOC	76.43	76.43	ROW	Broccoli	Lettuce, Head	Brussel Sprout		2
20007631	AW1423	Ranch 4 - Stella	LOMPOC	156.3	156.3	ROW	Broccoli	Artichoke	Lettuce, Head		2

20007626	AW1423	Ranch 3 - Puma	LOMPOC	108.06	108.06	ROW	Broccoli	Artichoke	Brussel Sprout		2
20007789	AW1424	Muzzi Ranch	Pescadero	140	40	ROW	Brussel Sprout	Leek			2
20004107	AW1425	Ano Nuevo Flower Growers Inc	pescadero	70	0	ROW	Pumpkin	Leek		CHLORPYRIFOS	2
20003381	AW1427	yaozhi huang nursery	gilroy	4	0	GREENHOUSE					2
20005100	AW1432	sunset	watsonville, ca	66	66	ROW	Strawberry				2
20005075	AW1433	Banovac	Watsonville	26	0	ROW	Lettuce, Head	Lettuce, Leaf		DIAZINON	2
20004933	AW1433	Enemark	Moss Landing	49	0	ROW	Lettuce, Head	Lettuce, Leaf		DIAZINON	2
20004985	AW1433	Travers Cassin	Aromas	104	0	ROW	Lettuce, Head	Lettuce, Leaf		DIAZINON	2
20004976	AW1433	Murphy	Aromas	128	0	ROW	Lettuce, Head	Lettuce, Leaf		DIAZINON	2
20005021	AW1433	Wait	Watsonville	51	0	ROW	Lettuce, Head	Lettuce, Leaf		DIAZINON	2
20005095	AW1433	Kazuka	Watsonville	18	0	ROW	Lettuce, Head	Lettuce, Leaf		DIAZINON	2
20005052	AW1433	Kelly Thompson	Watsonville	427	0	ROW	Lettuce, Head	Lettuce, Leaf	Strawberry	DIAZINON	2
20005111	AW1433	Overfelt	Hollister	470	0	ROW	Lettuce, Leaf	Spinach		DIAZINON	2
20005048	AW1433	Yamamoto	Watsonville	13	0	ROW	Lettuce, Head	Lettuce, Leaf		DIAZINON	2
20004924	AW1433	Chamberlain	Moss Landing	68	0	ROW	Lettuce, Head	Lettuce, Leaf		DIAZINON	2
20005031	AW1433	Redman	Watsonville	100	0	ROW	Lettuce, Head	Lettuce, Leaf		DIAZINON	2
20005039	AW1433	Kuhlitz	Watsonville	100	0	ROW	Lettuce, Head	Lettuce, Leaf		DIAZINON	2
20005065	AW1433	Crowley	Watsonville	45	0	ROW	Lettuce, Head	Lettuce, Leaf		DIAZINON	2
20005135	AW1433	Gomes	Hollister	109	0	ROW	Lettuce, Leaf	Spinach		DIAZINON	2
20004967	AW1433	Balich	Watsonville	102	0	ROW	Lettuce, Head	Lettuce, Leaf		DIAZINON	2
20005121	AW1433	Nutting	Hollister	120	0	ROW	Lettuce, Leaf			DIAZINON	2
20004943	AW1433	Struve ML	Moss Landing	56	0	ROW	Lettuce, Head	Lettuce, Leaf		DIAZINON	2
20004938	AW1433	Fegnolio	Moss Landing	22	0	ROW	Lettuce, Head	Lettuce, Leaf		DIAZINON	2
20005157	AW1433	Granite Rock	Hollister	12	0	ROW	Lettuce, Leaf	Spinach		DIAZINON	2
20005162	AW1433	Gumtree	Hollister	25	0	ROW	Tomato			DIAZINON	2
20004905	AW1433	Jensen	Moss Landing	50	0	ROW	Lettuce, Head	Lettuce, Leaf		DIAZINON	2
20004949	AW1433	Giberson	Moss Landing	84	0	ROW	Lettuce, Head	Lettuce, Leaf		DIAZINON	2
20005084	AW1433	Zupan	Watsonville	14	0	ROW	Lettuce, Head	Lettuce, Leaf		DIAZINON	2
20005014	AW1433	Struve	Watsonville	149	0	ROW	Lettuce, Head	Lettuce, Leaf		DIAZINON	2
20005127	AW1433	Armanino	San Juan Bautista	300	28	ROW	Lettuce, Leaf	Spinach		DIAZINON	2
20005002	AW1433	Ring	Watsonville	28	0	ROW	Lettuce, Head	Lettuce, Leaf		DIAZINON	2
20004995	AW1433	Silliman	Watsonville	150	0	ROW	Lettuce, Head	Lettuce, Leaf		DIAZINON	2
20005218	AW1435	home ranch	santa cruz	191	5	ROW	Brussel Sprout	Leek	Pumpkin		2
20013095	AW1437	Bobeda Ranch	Watsonville	3	3	ROW	Blackberry				2
20012824	AW1437	Hirano Ranch	Watsonville	16	16	ROW	Strawberry				2
20003460	AW1445	Triangle E Farms	Maricopa	383	0	ROW	Onion, Dry	Oat			2
20001058	AW1446	California Tropics	Carpinteria	24	0	ORCHARD					2
20004771	AW1452	Main Street Ranch	Santa Maria	95	95	ROW	Strawberry				2
20005214	AW1452	Rio Mesa Berry Farms	Santa Maria	127	127	ROW	Broccoli				2
20000709	AW1454	valleyheart gardens	santa barbara	4	0	NURSERY				DIAZINON, CHLORPYRIFOS	2
20007170	AW1463	Lafond Vineyards	buellton CA 93427	75		VINEYARD					2
20005140	AW1465	West Coast Ranch	Watsonville	140	140	ROW	Strawberry				2
20005146	AW1465	Jensen Rd. Ranch	Watsonville,Ca.	139	139	ROW	Strawberry				2
20005167	AW1465	Panziera Ranch	Salinas	60	60	ROW	Strawberry				2
20005132	AW1465	Holly/Grass Ranch	Watsonville,Ca.	106	106	ROW	Strawberry				2
20005163	AW1465	Ferrasci Ranch	Salinas	165	165	ROW	Strawberry				2
20005155	AW1465	Beach Ranch	Watsonville	92	92	ROW	Strawberry				2
20001227	AW1467	KB Main	Watsonville	55	5	NURSERY, GREENHOUSE					2
20005845	AW1472	102 Lee Road	watsonville	20	12	ROW	Strawberry				2
20004074	AW1477	Sargent #2	Gilroy,CA	156.1	156.1	ROW	Lettuce, Leaf			DIAZINON	2
20004021	AW1477	Thompson	Watsonville, CA	50.5	50.5	ROW	Lettuce, Head			DIAZINON	2
20003835	AW1477	Molera #1 Ranch G	Castroville, CA	63.8	63.8	ROW	Lettuce, Head			DIAZINON	2
20003844	AW1477	Gordon	Watsonville, CA	44.5	44.5	ROW	Lettuce, Head			DIAZINON	2
20003932	AW1477	O'Connell	Watsonville, CA	121.5	121.5	ROW	Lettuce, Head	Lettuce, Leaf		DIAZINON	2
20003938	AW1477	Sheehy	Watsonville, CA	127.6	127.6	ROW	Lettuce, Head	Cabbage		DIAZINON	2
20003899	AW1477	Jensen	Watsonville, CA	22.5	22.5	ROW	Lettuce, Head	Lettuce, Leaf		DIAZINON	2
20004078	AW1477	Sargent	Gilroy,CA	144	144	ROW	Lettuce, Head	Lettuce, Leaf		DIAZINON	2
20004079	AW1477	Sargent Add'l	Gilroy, CA	160.6	160.6	ROW	Lettuce, Head	Lettuce, Leaf	Parsley	DIAZINON	2
20003935	AW1477	Riverside	Watsonville, CA	66.4	66.4	ROW	Lettuce, Head	Lettuce, Leaf			2
20004018	AW1477	Stolich	Watsonville, CA	49.1	49.1	ROW	Lettuce, Head			DIAZINON	2
20004075	AW1477	Sargent #2 - Add'l	Gilroy, CA	141.8	141.8	ROW	Lettuce, Leaf			DIAZINON	2
20004076	AW1477	Sargent #2 Add'l	Gilroy,CA	82.7	82.7	ROW	Lettuce, Leaf				2
20004080	AW1477	Sargent Add'l	Gilroy, CA	170.6	170.6	ROW	Lettuce, Head	Lettuce, Leaf	Cabbage	DIAZINON	2

20004098	AW1477	San Juan	San Juan Bautista, CA	44	44	ROW	Lettuce, Leaf			DIAZINON	2
20003795	AW1477	Breen	Hollister /ca	279	279	ROW	Lettuce, Head	Celery	Lettuce, Leaf	DIAZINON	2
20003836	AW1477	Molera #2 Ranch F	Castroville, CA	129.7	129.7	ROW	Lettuce, Head				2
20003825	AW1477	DSA	Watsonville, CA	35.7	35.7	ROW	Lettuce, Head	Lettuce, Leaf		DIAZINON	2
20003820	AW1477	Curtis	Watsonville, CA	66.5	66.5	ROW	Cabbage	Lettuce, Head		DIAZINON	2
20004050	AW1477	Prescott	San Juan Bautista, CA	61.3	61.3	ROW	Parsley	Lettuce, Leaf		DIAZINON	2
20003881	AW1477	Crossetti	Watsonville, CA	59.2	59.2	ROW	Lettuce, Head			DIAZINON	2
20004082	AW1477	Sargent Add'l	Gilroy,CA	17.4	17.4	ROW	Lettuce, Head			DIAZINON	2
20004496	AW1478	Ranch 17	Lompoc	95	95	ROW	Broccoli	Lettuce, Head	Celery	DIAZINON, CHLORPYRIFOS	2
20004459	AW1478	Ranch 10	Lompoc	94.5	94.5	ROW	Artichoke	Broccoli	Cauliflower	DIAZINON, CHLORPYRIFOS	2
20004457	AW1478	Ranch 9	Lompoc	51	51	ROW	Broccoli	Cauliflower	Celery	DIAZINON, CHLORPYRIFOS	2
20004426	AW1478	Ranch 4	Lompoc	72	72	ROW	Celery	Lettuce, Head	Broccoli	DIAZINON, CHLORPYRIFOS	2
20004499	AW1478	Ranch 18	Lompoc	37	37	ROW	Broccoli	Cauliflower	Lettuce, Head	DIAZINON, CHLORPYRIFOS	2
20004480	AW1478	Ranch 14	Lompoc	57	57	ROW	Broccoli	Lettuce, Head	Celery	DIAZINON, CHLORPYRIFOS	2
20004623	AW1478	Ranch 25	Lompoc	38	38	ROW	Broccoli	Cauliflower	Lettuce, Head	DIAZINON, CHLORPYRIFOS	2
20004487	AW1478	Ranch 15	Lompoc	105	105	ROW	Artichoke	Broccoli	Lettuce, Head	DIAZINON, CHLORPYRIFOS	2
20004475	AW1478	Ranch 13	Lompoc	26	26	ROW	Broccoli	Lettuce, Head	Celery	DIAZINON, CHLORPYRIFOS	2
20004620	AW1478	Ranch 24	Lompoc	37.1	37.1	ROW	Lettuce, Head	Celery	Broccoli	DIAZINON, CHLORPYRIFOS	2
20004584	AW1478	Ranch 22	Lompoc	36	0	ROW	Lettuce, Head	Celery	Broccoli	DIAZINON, CHLORPYRIFOS	2
20004542	AW1478	Ranch 21	Lompoc	64	64	ROW	Broccoli	Lettuce, Head	Celery	DIAZINON, CHLORPYRIFOS	2
20004420	AW1478	Ranch 2	Lompoc	141	141	ROW	Broccoli	Cauliflower	Celery	DIAZINON, CHLORPYRIFOS	2
20004445	AW1478	Ranch 7	Lompoc	60	60	ROW	Cauliflower	Celery	Lettuce, Head	DIAZINON, CHLORPYRIFOS	2
20004619	AW1478	Ranch 23	Lompoc	113	113	ROW	Artichoke	Cauliflower	Lettuce, Head	DIAZINON, CHLORPYRIFOS	2
20004439	AW1478	Ranch 5	Lompoc	75	75	ROW	Lettuce, Head	Broccoli	Cauliflower	DIAZINON, CHLORPYRIFOS	2
20004443	AW1478	Ranch 6	Lompoc	140	140	ROW	Broccoli	Cauliflower	Celery	DIAZINON, CHLORPYRIFOS	2
20004464	AW1478	Ranch 11	Lompoc	33.5	33.5	ROW	Broccoli	Cauliflower	Lettuce, Head	DIAZINON, CHLORPYRIFOS	2
20004465	AW1478	Ranch 12	Lompoc	47	47	ROW	Cauliflower	Celery	Lettuce, Head	DIAZINON, CHLORPYRIFOS	2
20004489	AW1478	Ranch 16	Lompoc	115	115	ROW, NURSERY	Lettuce, Head	Cauliflower	Celery	DIAZINON, CHLORPYRIFOS	2
20004519	AW1478	Ranch 20	Lompoc	33	33	ROW	Broccoli	Cauliflower	Lettuce, Head	DIAZINON, CHLORPYRIFOS	2
20004422	AW1478	Ranch 3	Lompoc	103.5	103.5	ROW	Cauliflower	Celery	Lettuce, Head	DIAZINON, CHLORPYRIFOS	2
20004453	AW1478	Ranch 8	Lompoc	68.1	68.1	ROW	Celery	Lettuce, Head	Artichoke	DIAZINON, CHLORPYRIFOS	2
20004628	AW1478	Ranch 28	Lompoc	78	78	ROW	Broccoli	Cauliflower	Lettuce, Head	DIAZINON, CHLORPYRIFOS	2
20004419	AW1478	Ranch 1	Lompoc	109	109	ROW	Artichoke	Broccoli	Cauliflower	DIAZINON, CHLORPYRIFOS	2
20002679	AW1484	Pura & Delminico Ranch 1	Greenfield	156	0	ROW	Lettuce, Head	Broccoli	Celery	DIAZINON, CHLORPYRIFOS	2
20002684	AW1484	Pura & Delminico Ranch 2	Greenfield	128	0	ROW	Lettuce, Head	Broccoli	Celery	DIAZINON, CHLORPYRIFOS	2
20005070	AW1485	MILTON	SOLEDAD	64	0	ROW	Broccoli	Lettuce, Leaf	Peas		2
20005093	AW1485	BINSACCA	SOLEDAD	63.5	0	ROW	Broccoli	Lettuce, Leaf	Peas		2
20004152	AW1486	ALISAL RANCH	SALINAS	98	2	ROW	Strawberry				2
20008237	AW1486	Ballin Ranch	Salinas	112	1	ROW	Strawberry				2
20004151	AW1486	SUGAR LOAF RANCH	SALINAS	168	2	ROW	Strawberry				2
20004411	AW1486	SUGARLOAF CANYON	SALINAS	70		ROW	Strawberry				2
20004147	AW1486	UCHADA HOME RANCH	SALINAS	240	0	ROW	Strawberry				2
20008574	AW1489	Cassin Ranch	Watsonville	85	85	ROW	Raspberry				2
20009002	AW1490	Dolan Ranch	Moss Landing	14		ROW	Strawberry	Tomato			2
20009222	AW1492	Gambetta Ranch	Salinas	127	127	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf		2
20004912	AW1492	Spence Ranch	Salinas	304.5	304.5	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		2
20004850	AW1492	Mortensen Ranch	Salinas	237.1	17.4	ROW	Lettuce, Leaf	Peas	Broccoli		2
20005049	AW1492	Pedrazzi Ranch	Salinas	275.9		ROW	Lettuce, Head	Lettuce, Leaf	Cauliflower		2
20004986	AW1492	Martella Ranch	Salinas	93.2		ROW	Lettuce, Head	Lettuce, Leaf	Cauliflower		2
20005012	AW1492	Lanini Ranch	Salinas	78.4		ROW	Lettuce, Head	Lettuce, Leaf	Cauliflower		2
20004968	AW1492	Silva Ranch	Salinas	110.7		ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		2
20004931	AW1492	Chular Ranch	salinas	349.1		ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		2
20005030	AW1492	Alsop Ranch	Salinas	47.9		ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		2
20004833	AW1492	Abeloe Ranch	Salinas	125.6		ROW	Lettuce, Head	Lettuce, Leaf	Cauliflower		2
20004829	AW1492	Davis Ranch	Salinas	271.4		ROW	Lettuce, Head	Lettuce, Leaf	Cauliflower		2
20004819	AW1492	Garlinger Ranch	Salinas	302.1	0	ROW	Lettuce, Leaf	Peas	Broccoli		2
20004824	AW1492	Watson Ranch	Salinas	211.6	211.6	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		2
20003815	AW1494	Home	Salinas	76.6	0	ROW	Strawberry	Broccoli	Lettuce, Leaf		2
20003818	AW1494	Spreckels	Salinas	378.4	0	ROW	Strawberry	Lettuce, Leaf	Lettuce, Head		2
20003816	AW1494	Toro	Salinas	57	8	ROW	Broccoli	Strawberry	Lettuce, Head		2
20003810	AW1494	Jacks	Salinas	465.8	0	ROW	Lettuce, Head	Strawberry	Broccoli		2
20003957	AW1494	Selva	Gonzales	88.5	0	ROW	Lettuce, Head	Broccoli	Lettuce, Leaf		2
20003958	AW1494	Hilltop Ferini	Salinas	3	0	ROW	Pumpkin	Corn, Human Con.			2

20003939	AW1494	Cooper	Salinas	197.9	194.3	ROW	Lettuce, Head	Lettuce, Leaf	Strawberry		2
20003916	AW1494	Airport	Salinas	390.6	75.9	ROW	Strawberry	Lettuce, Leaf	Lettuce, Head		2
20003960	AW1494	Nashua	Salinas	81.8	0	ROW	Lettuce, Head	Broccoli	Strawberry		2
20003867	AW1494	Omo	Gonzales	150.2	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		2
20003934	AW1494	Storm	Salinas	123	31.2	ROW	Lettuce, Head	Lettuce, Leaf	Strawberry		2
20003927	AW1494	Norton	Salinas	373.1	46.8	ROW	Broccoli	Lettuce, Leaf	Cauliflower		2
20000625	AW1496	GALLAGHER	San Ardo	183.3	0	ROW	Cabbage	Spinach	Pepper, Fruiting		2
20000606	AW1496	SAN LUCAS VINEYARD	KING CITY	843.9	0	VINEYARD					2
20000612	AW1496	Foletta	KING CITY	73	0	ROW	Lettuce, Leaf	Spinach			2
20000613	AW1496	Ferrini	San Ardo	180.43	0	ROW	Lettuce, Leaf	Spinach	Onion, Dry		2
20000601	AW1496	SAN LUCAS ROW CROP	KING CITY	2103.2	0	ROW	Lettuce, Head	Spinach	Cabbage		2
20000619	AW1496	BRESCHINI	KING CITY	74.8	0	ROW	Spinach	Cabbage	Lettuce, Head		2
20000621	AW1496	CHERRY	San Ardo	165.7	0	ROW	Spinach				2
20000623	AW1496	GLAU	San Ardo	105.7	0	ROW	Lettuce, Leaf	Spinach	Other		2
20000624	AW1496	LOMBARDI	San Ardo	225.2	0	ROW	Spinach	Cabbage	Lettuce, Leaf		2
20000628	AW1496	TOGNETTI	SAN LUCAS	191.8	0	ROW	Broccoli	Cabbage	Spinach		2
20000615	AW1496	Culver/Rainbow	KING CITY	744	0	ROW	Lettuce, Leaf	Spinach	Cabbage		2
20000618	AW1496	DUDLEY-GRIMES	KING CITY	92	0	ROW	Spinach	Lettuce, Leaf			2
20000617	AW1496	Lynch	KING CITY	234.6	0	ROW	Spinach	Lettuce, Leaf	Pepper, Fruiting		2
20003896	AW1499	Sherwood Ranch	Salinas	38.7	0	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20003917	AW1499	Mothershed Ranch	Salinas	140.5	70.1	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20003780	AW1499	Chappel Ranch	Salinas	59.4	59.4	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20003819	AW1499	Home Ranch	Salinas	25.7	0	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20003812	AW1499	Koue Ranch	Salinas	93.5	93.5	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20003778	AW1499	Hitchcock Ranch	Salinas	169.2	169.2	ROW	Lettuce, Head	Broccoli	Cauliflower		2
20003793	AW1499	Reservation Ranch	Salinas	94.3	0	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20003888	AW1499	Juhler Ranch	Saliinas	102.4	0	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20003903	AW1499	Davis Ranch	Salinas	264	214.6	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20007608	AW1505	Arnaudo Ranch	Watsonville	3		ORCHARD	Apple			DIAZINON	2
20002786	AW1505	Hillview Farm	Watsonvilee	3	3	ROW, ORCHARD	Apple	Pear		DIAZINON	2
20001177	AW1508	Spring Valley Wholesale Nursery	La Selva Beach	5	5	NURSERY				CHLORPYRIFOS	2
20003876	AW1509	Mine Ranch	watsonville	79	0	ROW	Strawberry				2
20002791	AW1513	1A	Soquel	4	4	NURSERY					2
20002796	AW1513	2A	Soquel	3	3	NURSERY					2
20004870	AW1514	Kane Ranch	Watsonville	58	0	ROW	Strawberry				2
20004836	AW1514	Holohan Ranch	Watsonville	125	0	ROW	Blackberry	Raspberry			2
20004877	AW1514	Legend Ranch	Aromas	59	0	ROW	Raspberry				2
20004589	AW1516	Kono & Sons, Inc.	Carpinteria	16	0	ORCHARD, GREENHOUSE	Avocado	Other		DIAZINON, CHLORPYRIFOS	2
20001220	AW1518	Ranch 3	Santa Maria	122	72	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20001218	AW1518	Ranch 2	Santa Maria	75	75	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20001215	AW1518	Ranch 1	Santa Maria	95	95	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20007125	aw1521	Nishimura 2	Carpinteria	28		ORCHARD	Avocado				2
20010046	AW1523	Betteravia Properties (8,11,14,65)	Santa Maria	445	134	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20010044	AW1523	LeRoy (10)	Santa Maria	336	101	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20010962	AW1523	Ferrari Family Trust (58,74)	Santa Maria	159	48	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20010047	AW1523	Betteravia Properties (21)	Santa Maria	139	42	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20009974	AW1523	Grubstake (71,76)	Santa Maria	184	55	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20009942	AW1523	Ferini Ranches (6,7)	Santa Maria	237	71	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20009964	AW1523	Acquistapace (30)	Santa Maria	299	90	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20004460	AW1523	Canada (44,45)	Santa Maria	192	58	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20009922	AW1523	Pezzoni (4,5)	Santa Maria	171	51	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20004574	AW1523	Tomooka (43,47,48,49)	Santa Maria	392	118	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20009962	AW1523	Laine/Wortley (9)	Santa Maria	146	44	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20009963	AW1523	Franklin (12,61)	Santa Maria	149	45	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20009967	AW1523	Waller (20)	Santa Maria	121	36	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20009969	AW1523	Moretti (15)	Santa Maria	431	129	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20009966	AW1523	Ardantz (25,51)	Santa Maria	312	94	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20009976	AW1523	Silva/Simas (72)	Santa Maria	104	31	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20009973	AW1523	Tognazzini (16,73)	Santa Maria	254	76	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20010042	AW1523	LeRoy (56,67,60)	Guadalupe	454	136	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20010048	AW1523	Betteravia Investments (17,46)	Santa Maria	156	47	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20010043	AW1523	LeRoy (77)	Santa Maria	75	23	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20008547	AW1524	Mock, Marcella	Gilroy	215	0	ROW	Corn, Human Con.	Lettuce, Leaf	Tomato		2

20005261	AW1524	Nagareda	Gilroy	51	0	ROW	Corn, Human Con.	Pepper, Fruiting	Tomato		2
20008482	AW1524	Mandellie, Gubser	Gilroy	82	0	ROW	Pepper, Fruiting	Corn, Human Con.	Tomato		2
20008551	AW1524	Las Animas, Yamanie	Gilroy	53	0	ROW	Corn, Human Con.	Pepper, Fruiting	Tomato		2
20008539	AW1524	Dunlap	Gilroy	105	0	ROW	Corn, Human Con.	Lettuce, Leaf	Tomato		2
20005301	AW1524	Vineyard	Gilroy	293	20	ROW	Corn, Human Con.	Pepper, Fruiting	Tomato		2
20005264	AW1524	Kishimura	Gilroy	155	0	ROW	Corn, Human Con.	Pepper, Fruiting	Tomato		2
20005300	AW1524	Tripple F	Gilroy	160	0	ROW	Corn, Human Con.	Pepper, Fruiting	Tomato		2
20008545	AW1524	Untite, Nakasima, Belleza	Gilroy	154	0	ROW	Corn, Human Con.	Pepper, Fruiting	Tomato		2
20008540	AW1524	Keavney, Noll	Gilroy	350	0	ROW	Corn, Human Con.	Lettuce, Leaf	Pepper, Fruiting		2
20005260	AW1524	Crossroads	gilroy	70	0	ROW	Corn, Human Con.	Pepper, Fruiting	Tomato		2
20005700	AW1527	Swanton Berry Farms	Davenport	97	10	ROW	Broccoli	Strawberry	Blackberry		2
20005761	AW1528	Israel Zepeda Farms	Watsonville	28	0	ROW	Strawberry				2
20004351	AW1534	Buena Vista Ranch	Watsonville	162	0	ROW	Strawberry				2
20004339	AW1534	Springfield	Moss Landing	138	0	ROW	Strawberry				2
20004346	AW1534	Pasto Ranch	Watsonville	140	0	ROW	Strawberry				2
20004763	AW1536	Corralitos Ranch	Watsonville	24	0	ORCHARD	Apple				2
20009142	AW1541	Clark	Watsonville	12	0	ROW	Squash	Tomato	Bean, Unspecified		2
20003920	AW1543	Corralitos Ranch	watsonville	26	0	ROW	Strawberry				2
20000852	AW1545	Gold Rush Nursery	Soquel	0.25	0	NURSERY					2
20004934	AW1547	Varni Site 11A	Watsonville	18	0	ROW	Blackberry				2
20004956	AW1547	Murphy Hill Site 01	Aromas	87.57	0	ROW	Raspberry	Blackberry			2
20004926	AW1547	Radin Site 6A	Watsonville	18.66	0	ROW	Blackberry				2
20004897	AW1550	Borina Home Ranch	Watsonville	110.25	0	ROW	Strawberry	Lettuce, Head			2
20004901	AW1550	Grimmer Ranch	Watsonville	88	88	ROW	Strawberry	Lettuce, Leaf			2
20004854	AW1550	Dunbarton Ranch	Aromas	40	40	ROW	Strawberry				2
20004903	AW1550	North Wiley	Watsonville	25	25	ROW	Blackberry				2
20004890	AW1550	Corey Road Ranch	Aromas	8.5	8.5	ROW	Raspberry				2
20013002	AW1551	BUENA VISTA RANCH	WATSONVILLE, CA	22.85	0	NURSERY				CHLORPYRIFOS	2
20013022	AW1551	GIACOMAZZI RANCH	PRUNEDALE, CA	107	0	NURSERY				CHLORPYRIFOS	2
20003875	AW1551	RANCHO SAN JUAN	SALINAS	22	0	NURSERY				CHLORPYRIFOS	2
20003655	AW1551	DOLAN RANCH	MOSS LANDING	40	0	NURSERY				CHLORPYRIFOS	2
20003673	AW1551	LEWIS RANCH	PRUNEDALE	40.5		NURSERY				CHLORPYRIFOS	2
20003664	AW1551	GULLO RANCH	WATSONVILLE	40		NURSERY				CHLORPYRIFOS	2
20003677	AW1551	MANRESA RANCH	WATSONVILLE	23.7	0	NURSERY				CHLORPYRIFOS	2
20003910	AW1551	SUNRISE RANCH	MOSS LANDING	2.5	0	NURSERY				CHLORPYRIFOS	2
20003857	AW1551	PVWMA RANCH	WATSONVILLE	5	0	NURSERY				CHLORPYRIFOS	2
20003843	AW1551	MONTEREY BAY ACADEMY RANCH	WATSONVILLE	34.5	0	NURSERY				CHLORPYRIFOS	2
20003660	AW1551	GULARTE RANCH	SALINAS	110	0	NURSERY				CHLORPYRIFOS	2
20003626	AW1551	JETBERG	WATSONVILLE	128.4	0	NURSERY				CHLORPYRIFOS	2
20003817	AW1552	DeBernardi Bros.	Santa Maria	207	20	ROW	Broccoli	Lettuce, Head	Strawberry		2
20003463	AW1556	Rancho Santa Maria	Watsonville	165	0	ROW	Blackberry	Blueberry	Strawberry		2
20003351	AW1556	Cox	Watsonville	33.9	0	ROW	Strawberry			DIAZINON	2
20003352	AW1556	Curtis	Watsonville	40	0	ROW	Blackberry	Strawberry		DIAZINON	2
20003341	AW1556	Cassidy	Aromas	70.9	0	ROW	Strawberry	Raspberry			2
20003454	AW1556	Redman	Watsonville	20	0	ROW	Strawberry				2
20003475	AW1556	Sheehy	Watsonville	19.01	0	ROW	Strawberry			DIAZINON	2
20003462	AW1556	San Juan Oaks	San Juan Bautista	98.4	0	ROW	Blackberry	Raspberry	Blueberry		2
20003519	AW1556	Enemark	Watsonville	25	0	ROW	Strawberry			DIAZINON	2
20003357	AW1556	Gordon	Watsonville	17.4	0	ROW	Strawberry			DIAZINON	2
20003400	AW1556	Jensen	Watsonville	46.8	0	ROW	Strawberry			DIAZINON	2
20003401	AW1556	Colendich	Watsonville	46	0	ROW	Strawberry			DIAZINON	2
20003424	AW1556	Matthews	Aromas	17.8	0	ROW	Raspberry				2
20003364	AW1556	Hackman	Aromas	74.74	0	ROW	Raspberry	Strawberry			2
20003450	AW1556	Overfelt	San Juan Bautista	86	0	ROW	Blackberry	Raspberry			2
20003337	AW1556	Bird	Watsonville CA	37.3	0	ROW	Raspberry				2
20003426	AW1556	Matulich	Watsonville	92.1	0	ROW	Strawberry				2
20003393	AW1556	Harney	Watsonville	24	0	ROW	Strawberry			DIAZINON	2
20003395	AW1556	Hoyts	Watsonville	6	0	ROW	Raspberry				2
20000978	AW1560	Enos Ranch 4	Santa Maria	90	45	ROW	Broccoli	Spinach			2
20010428	AW1560	Billy Colli Ranch	Santa Maria	160	0	ROW	Broccoli				2
20010422	AW1560	Gold Coast Farms Ranch 1	Santa Maria	120	60	ROW	Broccoli	Spinach	Mustard		2
20010426	AW1560	Gold Coast Farms Ranch 5	Santa Maria	156	0	ROW, VINEYARD	Broccoli	Grapes, Wine			2
20007494	AW1561	reed ranch 9	greenfield	173	0	ROW	Celery	Lettuce, Head	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2

20007496	AW1561	Gianolini ranch 12	greenfield	266	0	ROW	Carrot	Broccoli	Lettuce, Head		2
20007345	AW1561	bassetti ranch 3	greenfield	248	0	ROW	Carrot	Broccoli	Celery	DIAZINON, CHLORPYRIFOS	2
20007498	AW1561	bravo ranch 15	greenfield	97	0	ROW	Celery	Lettuce, Head	Broccoli	CHLORPYRIFOS	2
20007326	AW1561	hiserman ranch 1	greenfield	190	0	ROW	Lettuce, Head	Broccoli	Carrot	DIAZINON, CHLORPYRIFOS	2
20007348	AW1561	morinini ranch 6	greenfield	115	0	ROW	Carrot	Broccoli	Spinach	DIAZINON, CHLORPYRIFOS	2
20007351	AW1561	dolan ranch 7	greenfield	188	0	ROW	Lettuce, Head	Lettuce, Leaf	Celery	DIAZINON, CHLORPYRIFOS	2
20007344	AW1561	aurignac ranch 2	greenfield	98	0	ROW	Lettuce, Leaf	Broccoli	Spinach	DIAZINON, CHLORPYRIFOS	2
20007346	AW1561	orradre ranch 4	greenfield	441	0	ROW	Bean, Unspecified	Lettuce, Head	Celery	DIAZINON, CHLORPYRIFOS	2
20007354	AW1561	bassetti ranch 8	greenfield	44	0	ROW	Celery	Lettuce, Head	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20003263	AW1568	RANCH 15	NIPOMO	75.9	98.8	ROW	Broccoli	Strawberry	Lettuce, Head		2
20002818	AW1571	HIBINO RANCH #11	Gonzales	85.2	0	ROW	Lettuce, Head	Lettuce, Leaf	Cauliflower	DIAZINON	2
20002804	AW1571	Foletta Ranch 4	GONZALES	73.7	0	ROW	Broccoli	Lettuce, Head	Celery	DIAZINON	2
20002805	AW1571	Nunes Ranch #6	GONZALES	131.6	0	ROW	Lettuce, Leaf	Broccoli	Celery		2
20002802	AW1571	RANCH 2 (FRIEDRICH)	GONZALES	117.8	0	ROW	Broccoli	Lettuce, Leaf	Cauliflower		2
20002794	AW1571	JOHNSEN RANCH	KING CITY	100	0	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf	DIAZINON	2
20002825	AW1571	IKEDA RANCH	GONZALES	97.2	0	ROW	Lettuce, Head	Lettuce, Leaf	Cauliflower	DIAZINON	2
20002824	AW1571	RIANDA RANCH	GONZALES	137.5	0	ROW	Carrot	Cauliflower	Broccoli	DIAZINON	2
20002823	AW1571	SOMMERS RANCH	GONZALES	109	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		2
20009782	AW1571	REDDING RANCH	GREENFIELD	228.8		ROW	Broccoli	Lettuce, Head	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20002827	AW1571	CICARDINI RANCH	KING CITY	159.3	0	ROW	Lettuce, Leaf	Lettuce, Head	Cauliflower		2
20002797	AW1571	SOLARI RANCH	KING CITY	100	0	ROW	Broccoli	Celery	Onion, Green	DIAZINON	2
20002795	AW1571	FOLETTA RANCH	KING CITY	248	0	ROW	Cauliflower	Broccoli	Lettuce, Head	DIAZINON	2
20002817	AW1571	Doud Ranch #10	Gonzales	464.1	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	DIAZINON	2
20002831	AW1571	YUKI RANCH	GONZALES	133.2	0	ROW	Other			DIAZINON	2
20002803	AW1571	CORDA RANCH 3	GONZALES	89.2	0	ROW	Cauliflower	Lettuce, Head	Broccoli	DIAZINON	2
20002807	AW1571	LANINI RANCH #8	GONZALES	269.9	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	DIAZINON	2
20000700	AW1579	Paradise Christmas Tree Farm	Morgan Hill	4	0	ORCHARD	Other				2
20005306	AW1595	Abeloe	salinas	180	0	ROW	Strawberry				2
20005308	AW1595	Settrini Ranch	salinas	180	180	ROW	Strawberry				2
20005307	AW1595	Marci Ranch	salinas	70	70	ROW	Strawberry				2
20005305	AW1595	Sala Ranch	salinas	200	200	ROW	Strawberry				2
20005304	AW1595	Blanco Ranch	salinas	180	0	ROW	Strawberry				2
20012103	AW1596	Blanco	Salinas	34.2	0	ROW	Strawberry				2
20003648	AW1596	Loveland	Aromas	95	106	ROW	Raspberry	Strawberry	Blackberry		2
20003656	AW1596	Ryan Ranch	Salinas	69.7	69.7	ROW	Strawberry				2
20003658	AW1596	Schultz Ranch	Salinas	91.6	183.2	ROW	Strawberry				2
20008062	AW1602	Faurot ranch LLC	Watsonville	80		ROW	Lettuce, Leaf	Carrot	Radish		2
20003911	AW1604	Alamo Farming / Ranch #5	Santa Maria	52	52	ROW	Broccoli	Cauliflower	Bean, Dried		2
20003889	AW1604	Alamo Farming / Ranch #1	Santa Maria	150	150	ROW	Celery	Cauliflower	Broccoli		2
20003906	AW1604	Alamo Farming / Ranch #4	Santa Maria	54	54	ROW	Broccoli	Cauliflower	Bean, Dried		2
20003918	AW1604	Alamo Farming / Ranch #7	Santa Maria	151	151	ROW	Broccoli	Cauliflower	Bean, Dried		2
20003925	AW1604	Alamo Farming / Ranch #9	Santa Maria	90	90	ROW	Strawberry	Broccoli	Cauliflower		2
20004210	AW1613	SPRING FIELD RANCH	MOSS LANDING	16		ROW	Strawberry				2
20004207	AW1613	GALVAN RANCH	MOSS LANDING	51	0	ROW	Strawberry				2
20004212	AW1613	MANRESA RANCH	SANTA CRUZ	100	2	ROW	Strawberry				2
20004214	AW1614	AZEVEDO RANCH	WATSONVILLE	26	0	ROW	Strawberry				2
20003645	AW1617	Spreckles	Salinas	40	0	ROW	Strawberry			DIAZINON	2
20002625	AW1620	Sinton Ranch	Santa Maria	170	170	ROW	Broccoli	Celery			2
20002642	AW1620	SBR Ranch	Santa Maria	50	50	ROW	Broccoli				2
20002641	AW1620	SISQUOC RANCH	GAREY	250	250	ROW	Broccoli	Celery			2
20008543	AW1622	Boronda	Salinas	74		ROW	Cauliflower	Lettuce, Leaf	Celery		2
20003130	AW1627	Tarp and Neubert Ranch - West	Salinas	61.1	0	ROW	Blueberry	Broccoli	Strawberry		2
20003128	AW1627	Madalora	Salinas	104	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	DIAZINON, CHLORPYRIFOS	2
20003129	AW1627	Tarp and Neubert Ranch - East	Salinas	62.2	0	ROW	Strawberry	Broccoli			2
20003122	AW1627	Tamagni Ranch	Salinas	151	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		2
20003126	AW1627	Machado	Salinas	88	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		2
20003127	AW1627	Teraji Ranch	Salinas	37	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		2
20001095	AW1628	Fabretti & Dedini	Greenfield	300	0	ROW	Broccoli	Celery	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20000771	AW1629	Nevins Ranch 6	Greenfield	175	0	ROW	Lettuce, Leaf	Broccoli	Celery		2
20000766	AW1629	Norman Ranch 4	Greenfield	180	0	ROW	Lettuce, Leaf	Spinach	Celery	DIAZINON	2
20000762	AW1629	Eldon Pura Ranch 3	Greenfield	175.6	0	ROW	Lettuce, Leaf	Spinach	Celery	DIAZINON	2
20000758	AW1629	Pura Home Ranch 1	Greenfield	218.5	0	ROW	Celery	Lettuce, Leaf	Onion, Dry	DIAZINON, CHLORPYRIFOS	2
20000767	AW1629	Pura Ranch 5	Greenfield	107	0	ROW	Lettuce, Leaf	Spinach	Bean, Dried	DIAZINON, CHLORPYRIFOS	2

20004159	AW1631	Mission	Soledad	285	30	ROW	Lettuce, Head	Lettuce, Leaf	Celery		2
20004157	AW1631	Torroni	Soledad	65	0	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf		2
20004153	AW1631	Jacks	Soledad	120	20	ROW	Bean, Dried	Lettuce, Head	Lettuce, Leaf		2
20000855	AW1633	Home Ranch	Salinas	195	195	ROW	Lettuce, Leaf	Broccoli	Lettuce, Head		2
20007539	AW1634	Allen Gill	King City	314	314	ROW	Lettuce, Head	Broccoli	Spinach		2
20007535	AW1634	Wimer Ranch	Chualar	125	0	ROW	Lettuce, Leaf	Lettuce, Head	Broccoli		2
20007533	AW1634	Bardin Ranch	Salinas	128	0	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf		2
20007534	AW1634	Moore Ranch	Gonzales	263	0	ROW	Spinach	Broccoli	Cauliflower		2
20007536	AW1634	Shrine Ranch	Chualar	375	0	ROW	Cauliflower	Lettuce, Head	Spinach		2
20007538	AW1634	Salanco Ranch	King City	204	204	ROW	Broccoli	Lettuce, Leaf	Spinach		2
20007540	AW1634	Herbert Ranch	King City	301	150	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf		2
20004377	AW1637	Broome 3	Chualar	180.2	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	CHLORPYRIFOS	2
20004375	AW1637	Broome 2	Chualar	341.7	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	CHLORPYRIFOS	2
20004370	AW1637	Violini Ranch	Salinas	47.1	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	CHLORPYRIFOS	2
20004366	AW1637	Home Ranch	Salinas	191.2	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	CHLORPYRIFOS	2
20008404	AW1641	Rossi-T&A Wing	Chualar	420.8	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	CHLORPYRIFOS	2
20004578	AW1641	T&A-Bardin	Salinas	232.2	187.4	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	CHLORPYRIFOS	2
20004612	AW1641	T&A-Daugherty	Salinas	92.8	92.8	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	CHLORPYRIFOS	2
20004616	AW1641	T&A-Dave McFadden	Salinas	279.2	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	CHLORPYRIFOS	2
20004630	AW1641	T&A-Porter Top	Salinas	74.6	67.5	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	CHLORPYRIFOS	2
20004633	AW1641	T&A-Stirling	Salinas	39.2	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	CHLORPYRIFOS	2
20004636	AW1641	Rossi-Hunter	Salinas	75.4	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	CHLORPYRIFOS	2
20004641	AW1641	Sullivan-Bardin	Salinas	142	124.4	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	CHLORPYRIFOS	2
20004660	AW1641	Natividad Nursery	Salinas	2	0	NURSERY					2
20004639	AW1641	Rossi-Storm	Salinas	115.5	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	CHLORPYRIFOS	2
20004640	AW1641	Sullivan-Admiral	Salinas	77.5	77.5	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	CHLORPYRIFOS	2
20004657	AW1641	Sullivan(Jerry Ramirez)-Wynne	Salinas	50.7	50.7	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	CHLORPYRIFOS	2
20004629	AW1641	T&A-Porter Bottom	Salinas	67.1	0	ROW	Lettuce, Leaf	Broccoli	Cauliflower	CHLORPYRIFOS	2
20004654	AW1641	Sullivan-Pomeroy	Salinas	73	56.3	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	CHLORPYRIFOS	2
20004617	AW1641	T&A-Foster	Salinas	96.1	96.1	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	CHLORPYRIFOS	2
20004610	AW1641	T&A-Black	Salinas	98.3	98.3	ROW	Lettuce, Head	Strawberry	Broccoli	CHLORPYRIFOS	2
20004627	AW1641	T&A-Nissen	Salinas	124.3	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	CHLORPYRIFOS	2
20004635	AW1641	Rossi-Harris	Salinas	160.8	59.1	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	CHLORPYRIFOS	2
20004624	AW1641	T&A-Knight	Salinas	171.6	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	CHLORPYRIFOS	2
20008408	AW1641	T&A/WellPict-Fuji-Molera	Salinas	51.8	12.4	ROW	Strawberry				2
20008403	AW1641	Sullivan(Jerry Ramirez)-Simon	Salinas	59.5	57	ROW	Lettuce, Head	Lettuce, Leaf			2
20008405	AW1641	Rossi-Massa Wing	Chualar	280.9	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	CHLORPYRIFOS	2
20004084	AW1642	Callahan	Gonzales	250	0	ROW	Broccoli	Bean, Dried	Lettuce, Leaf		2
20004359	AW1645	Gularte	Salinas	295.3	43.3	ROW	Strawberry	Lettuce, Head	Lettuce, Leaf		2
20004362	AW1645	Cummings Ranch	Salinas	379.6	130.4	ROW	Strawberry	Lettuce, Head	Lettuce, Leaf		2
20008528	AW1645	West Davis	Salinas	102.4	102.4	ROW	Strawberry	Lettuce, Head	Lettuce, Leaf		2
20010242	AW1645	Rancho Guadalupe #10	Santa Maria	122	0	ROW	Strawberry				2
20008323	AW1645	Admiral Ranch	Salinas	73	0	ROW	Strawberry				2
20008307	AW1645	Duncan	Salinas	228	127.1	ROW	Lettuce, Head	Strawberry			2
20004355	AW1645	Davis Ranch	Salinas	411.2	330.1	ROW	Strawberry	Lettuce, Head	Lettuce, Leaf		2
20002600	AW1647	Fujii2-10	Watsonville	96.6	96.6	ROW	Lettuce, Head	Celery	Broccoli	DIAZINON, CHLORPYRIFOS	2
20002605	AW1647	Molera2	Salinas	150.7	150.7	ROW	Lettuce, Head	Celery	Broccoli	DIAZINON, CHLORPYRIFOS	2
20002604	AW1647	Molera1	Salinas	264.3	264.3	ROW	Lettuce, Head	Celery	Broccoli	DIAZINON, CHLORPYRIFOS	2
20002572	AW1651	Tognetti	King City	79	0	ROW	Celery	Cauliflower	Lettuce, Head	DIAZINON, CHLORPYRIFOS	2
20002562	AW1651	D. Petit	King City	209	0	ROW	Lettuce, Leaf	Cauliflower	Lettuce, Head	DIAZINON, CHLORPYRIFOS	2
20002565	AW1651	Crinklaw	King City	227.9	0	ROW	Celery	Lettuce, Leaf	Onion, Dry	DIAZINON, CHLORPYRIFOS	2
20002554	AW1651	Bacciarini Home	King City	106.6	0	ROW	Lettuce, Head	Broccoli	Celery	DIAZINON, CHLORPYRIFOS	2
20002560	AW1651	Bacciarini East	King City	113.4	0	ROW	Lettuce, Head	Broccoli	Spinach	DIAZINON, CHLORPYRIFOS	2
20002564	AW1651	J. Petit	King City	374.2	0	ROW	Celery	Cauliflower	Lettuce, Head	DIAZINON, CHLORPYRIFOS	2
20002568	AW1651	Lesnini	King City	124	0	ROW	Broccoli	Lettuce, Head	Celery	DIAZINON, CHLORPYRIFOS	2
20002571	AW1651	Martella	King City	175.1	0	ROW	Celery	Lettuce, Leaf	Broccoli	DIAZINON, CHLORPYRIFOS	2
20002573	AW1651	Layous	King City	248.6	0	ROW	Lettuce, Leaf	Broccoli	Celery	DIAZINON, CHLORPYRIFOS	2
20002575	AW1651	Wilson West	King City	163.9	0	ROW	Lettuce, Leaf	Spinach	Kale	DIAZINON, CHLORPYRIFOS	2
20007818	Aw1653	Twissleman Ranch	San lucas	171.6	0	ROW	Lettuce, Head	Carrot	Cucumber		2
20004847	AW1654	Blanco Ranch	Salinas	97	65	ROW	Celery	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20005842	AW1657	Righello Ranch	Castroville	15	0	ROW	Strawberry			DIAZINON	2
20007526	AW1660	Sargenti/Ryan	Chualar	60	0	ROW, VINEYARD	Lettuce, Leaf	Broccoli	Grapes, Wine		2
20007527	AW1660	SILACCI	GONZALES	42	0	ROW	Lettuce, Leaf	Broccoli			2

20007288	AW1660	Tanimura Ranch	King City	120	0	ROW	Lettuce, Leaf	Broccoli	Celery	DIAZINON	2
20003200	AW1664	Silveria Home Ranch	Soledad	106	0	ROW	Broccoli	Lettuce, Leaf			2
20004029	AW1665	F1	watsonville	33	0	ROW	Other	Other	Other		2
20005561	AW1669	Home Ranch	Soledad	4	0	ROW	Broccoli	Lettuce, Leaf	Cauliflower	CHLORPYRIFOS	2
20004796	AW1670	Ashcraft Ranch	Watsonville	87	0	ROW	Strawberry				2
20004793	AW1672	Alexander / Borchard	Salinas	65	0	ROW	Strawberry				2
20004256	AW1679	ALTMAN PLANTS #3	SALINAS CA	10	10	GREENHOUSE					2
20003532	AW1680	Johnson Ranch	Soledad	130	0	ROW	Carrot	Broccoli	Lettuce, Head		2
20003537	AW1680	Morgantini Ranch	Soledad	320	0	ROW	Lettuce, Head	Cabbage	Carrot		2
20003530	AW1680	Los Coches	Soledad	172	0	ROW	Cabbage	Carrot	Broccoli		2
20003534	AW1680	Zabala Ranch	Soledad	363	120	ROW	Cabbage	Broccoli	Lettuce, Head		2
20003526	AW1680	Home Ranch	Soledad	220	60	ROW	Lettuce, Head	Broccoli	Cabbage		2
20003533	AW1680	Albertoni Ranch	Soledad	195	75	ROW	Broccoli	Cabbage	Lettuce, Head		2
20001403	AW1681	R34 / Pueblo	Greenfield	82.78	0	ROW	Lettuce, Head	Broccoli			2
20001392	AW1681	R22 / Baja Viento	Greenfield	166.03	0	ROW, VINEYARD	Broccoli	Onion, Dry	Pepper, Fruiting	CHLORPYRIFOS	2
20001395	AW1681	R31 / Central	Greenfield	232.69	0	VINEYARD				CHLORPYRIFOS	2
20001354	AW1681	R1 / Riverview	soledad	194.37	0	VINEYARD				CHLORPYRIFOS	2
20007794	AW1681	R33/Elm	Greenfield	53.11	0	VINEYARD				CHLORPYRIFOS	2
20001384	AW1681	R50 / San Lucas	san Lucas	831.72	0	VINEYARD				CHLORPYRIFOS	2
20001387	AW1681	R21 / Viento	Greenfield	208.14	0	VINEYARD				CHLORPYRIFOS	2
20001410	AW1681	H1 H2 H3 / Hames Valley	Bradley	942.2	942.2	VINEYARD				CHLORPYRIFOS	2
20001377	AW1681	R10 / Scheid	Greenfield	339.04	0	VINEYARD				CHLORPYRIFOS	2
20001398	AW1681	R32 / Hacienda	Greenfield	117.68	0	VINEYARD				CHLORPYRIFOS	2
20001405	AW1681	R35 / El Camino	Greenfield	44.65	0	ROW, VINEYARD	Broccoli	Onion, Green		CHLORPYRIFOS	2
20011442	AW1683	FREW RANCH	KING CITY	170.4	0	ROW	Broccoli	Peas	Lettuce, Head	DIAZINON, CHLORPYRIFOS	2
20009522	AW1683	HOMEN RANCH	KING CITY	345.2	0	ROW	Lettuce, Leaf	Peas	Broccoli	DIAZINON, CHLORPYRIFOS	2
20001372	AW1683	Tunnel Ranch	Greenfield	219.6	0	ROW	Broccoli	Peas	Lettuce, Head	DIAZINON, CHLORPYRIFOS	2
20001375	AW1683	Alves Ranch	Soledad	85	0	ROW	Onion, Dry	Lettuce, Leaf	Broccoli	DIAZINON, CHLORPYRIFOS	2
20001390	AW1683	Oshita Ranch	Soledad	307.9	0	ROW	Peas	Lettuce, Leaf	Broccoli	DIAZINON, CHLORPYRIFOS	2
20009502	AW1683	TUNNEL RANCH ORGANIC	GREENFIELD	37.9	0	ROW	Broccoli	Peas			2
20001382	AW1683	McCoy Ranch	Soledad	59.5	0	ROW	Broccoli	Tomato	Carrot	DIAZINON, CHLORPYRIFOS	2
20001399	AW1683	Piearcy Ranch Organic	Chualar	54.5	0	ROW	Broccoli	Peas			2
20001409	AW1683	Short Ranch	Chualar	143.5	113.5	ROW	Lettuce, Leaf	Broccoli	Peas	DIAZINON, CHLORPYRIFOS	2
20004432	AW1684	Color Spot Yard 1	Salinas	61	52	NURSERY, GREENHOUSE					2
20001463	AW1685	CENTRAL COAST GREENHOUSE	SALINAS	4	0	GREENHOUSE					2
20004235	AW1686	Eagle Organics / Hollenstien Ranch	Salinas	140	140	ROW	Strawberry				2
20009242	AW1688	CAPPURRO RANCH	MOSS LANDING	70	0	ROW	Strawberry				2
20007244	AW1689	Martin Brothers Ranch	Royal Oaks	23	10	ROW	Strawberry				2
20004477	AW1691	Live Oak Bazzi Family Ranch	Buellton	50		ROW	Squash	Pepper, Fruiting	Cucumber		2
20009722	AW1692	Alvarado Ranch	Aromas	14	14	ROW	Other			DIAZINON	2
20005760	AW1696	Rodgers Ranch	moss landing	114	0	ROW	Strawberry				2
20005762	AW1696	Minhoto Ranch	moss landing	126	0	ROW	Strawberry				2
20004189	AW1700	Herschbach	Soledad, CA	125	125	ROW	Carrot	Broccoli	Lettuce, Leaf	CHLORPYRIFOS	2
20004185	AW1700	Alarid Home Ranch	Soledad	193	193	ROW, VINEYARD, ORCHARD	Lettuce, Head	Broccoli	Lettuce, Leaf	CHLORPYRIFOS	2
20004180	AW1700	Bassetti Ranch	Salinas, CA	47	40	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf	CHLORPYRIFOS	2
20004705	AW1703	RDC	Salinas	80	80	ROW, ORCHARD	Broccoli	Strawberry	Tomato		2
20004706	AW1703	Triple M	Las Lomas	24	24	ROW	Strawberry	Squash, Summer	Broccoli		2
20008662	AW1708	ALEX CAMANY FARMS/HARNEY RANCH	SALINAS	132	0	ROW	Lettuce, Head	Celery	Broccoli	CHLORPYRIFOS	2
20004178	AW1709	Breschini	Salinas	179.23	30	ROW	Lettuce, Head	Broccoli	Cauliflower		2
20004198	AW1709	Frassetto	Salinas	35.8	0	ROW	Lettuce, Head	Cauliflower	Broccoli		2
20008332	AW1709	Salmina	Salinas	132.2		ROW	Lettuce, Head	Cauliflower	Broccoli		2
20004192	AW1709	Hurley	Salinas	75	0	ROW	Artichoke				2
20004197	AW1709	Borges	Salinas	65.5	46.8	ROW	Lettuce, Head	Strawberry	Cauliflower		2
20004205	AW1709	King	Castroville	245.2	245.2	ROW	Artichoke				2
20004206	AW1709	Martin	Castroville	71.3	21	ROW	Artichoke	Cauliflower	Lettuce, Head		2
20004211	AW1709	Armstrong	Castroville	138.1	74	ROW	Artichoke	Strawberry			2
20004169	AW1709	Spreckles	Salinas	387.2	0	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20004201	AW1709	Antique	Castroville	79.53	0	ROW	Artichoke	Lettuce, Head	Cauliflower		2
20004202	AW1709	Vessey	Castroville	194.1	194.1	ROW	Artichoke	Lettuce, Head	Cauliflower		2
20004208	AW1709	Ocean	Castroville	185	80	ROW	Artichoke	Lettuce, Head	Cauliflower		2
20004172	AW1709	Salinas	Salinas	104.8	0	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20004183	AW1709	Blanco	Salinas	50	47.6	ROW	Lettuce, Head	Cauliflower	Broccoli		2
20004186	AW1709	Luis	Salinas	81	81	ROW	Lettuce, Head	Cauliflower	Broccoli		2

20004795	AW1711	D'Arrigo Ranch #22	Salinas	120	0	ROW	Strawberry				2
20004288	AW1714	Nixon/Wilson	Salinas	257	173	ROW	Broccoli	Lettuce, Head	Chicory		2
20004266	AW1714	A.W. Johnson & Son Farming	Salinas	176	104	ROW	Broccoli	Lettuce, Head	Chicory		2
20004291	AW1714	A.W. Johnson & Son Farming	Salinas	144	120	ROW	Broccoli	Lettuce, Head	Chicory		2
20010162	AW1717	Byington Estate Vineyard	Los Gatos	8	0	ROW, VINEYARD	Grapes, Wine				2
20005130	AW1722	Sanders Ranch	Santa Maria	9.5	0	ROW	Other				2
20005115	AW1723	Home Ranch	Lompoc	100	70	ROW, ORCHARD	Bean, Dried	Broccoli	Walnut		2
20005137	AW1723	Harris	Lompoc	75	60	ROW	Broccoli	Bean, Unspecified	Lettuce, Head		2
20005131	AW1723	McHenry	Lompoc	110	90	ROW, VINEYARD, ORCHARD	Bean, Dried	Broccoli	Walnut		2
20011789	AW1726	BRAGA Moranda Ranch	Soledad	72.8	0	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf		2
20011784	AW1726	BRAGA Gularte Ranch	Soledad	320	0	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf		2
20011782	AW1726	Bassetti Ranch	Soledad	99.6	0	ROW	Broccoli	Lettuce, Leaf	Lettuce, Head		2
20011790	AW1726	BRAGA Ryan Ranch	Chualar	71.1	0	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf		2
20004272	AW1726	Dole	Soledad	293	0	ROW	Lettuce, Leaf	Cauliflower	Broccoli		2
20011783	AW1726	BRAGA Eade Ranch	San Ardo	417	0	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf		2
20011785	AW1726	BRAGA Home Ranch	Soledad	243	0	ROW	Broccoli	Lettuce, Leaf	Lettuce, Head		2
20011787	AW1726	BRAGA Latassa Ranch	Soledad	357.6	236	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf		2
20011791	AW1726	BRAGA Sargenti Ranch	Chualar	246.6	0	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf		2
20011786	AW1726	BRAGA Kelly Ranch	Greenfield	282	0	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf		2
20011788	AW1726	BRAGA Martin Ranch	Greenfield	220	0	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf		2
20004385	AW1733	Miller Merritt Trust Santa Rosa Road	Buellton	42	0	ROW	Tomato				2
20001204	AW1735	06 Goodchild	Sisqouc	72		VINEYARD	Grapes, Wine	Other		DIAZINON, CHLORPYRIFOS	2
20001199	AW1735	05 San Felicia/Ron's	Los Alamos	25		VINEYARD	Grapes, Wine			DIAZINON, CHLORPYRIFOS	2
20001197	AW1735	04 Don Miguel	Los Alamos	66		VINEYARD	Grapes, Wine			DIAZINON, CHLORPYRIFOS	2
20007230	AW1741	Castile, Richard S	Carpinteria	18	18	ORCHARD	Avocado				2
20000434	AW1741	Richard S Castile	Carpinteria	18	18	ORCHARD	Avocado				2
20000772	AW1743	Ranch 3	Lompoc	39		ROW	Bean, Unspecified				2
20003990	AW1747	Giudici Ranch	San Lucas	173	173	ROW	Lettuce, Leaf	Carrot	Spinach		2
20003987	AW1747	Home Ranch	Greenfield	218	0	ROW	Lettuce, Leaf	Spinach	Broccoli		2
20003988	AW1747	Zilioli	San Lucas	64	0	ROW	Carrot	Bean, Dried	Broccoli		2
20008552	AW1748	Butler Short Ranch	Soledad	136	0	ROW	Carrot	Broccoli	Lettuce, Head		2
20004293	AW1748	Freyer Ranch	Soledad	152.75	0	ROW	Broccoli	Cauliflower	Lettuce, Head	DIAZINON, CHLORPYRIFOS	2
20004296	AW1748	Firestone Ranch	Salinas	119.1	0	ROW	Broccoli	Cauliflower	Lettuce, Head	DIAZINON, CHLORPYRIFOS	2
20004298	AW1748	Ferrini Ranch	Salinas	122.1	0	ROW, VINEYARD	Broccoli	Cauliflower	Lettuce, Head	DIAZINON, CHLORPYRIFOS	2
20004303	AW1748	Felipe	Salinas	52	0	ROW	Broccoli	Cauliflower	Lettuce, Head	DIAZINON, CHLORPYRIFOS	2
20008549	AW1748	Manzoni Ranch	Soledad	143	0	ROW, VINEYARD	Carrot	Broccoli	Lettuce, Head		2
20000763	AW1751	FREW RANCH	Greenfield	158	0	ROW	Broccoli	Lettuce, Leaf	Bean, Dried	DIAZINON, CHLORPYRIFOS	2
20000781	AW1751	HOME RANCH	Greenfield	102	0	ROW	Peas	Broccoli	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20000784	AW1751	Salinas Land Company II	King City	260	226	ROW	Broccoli	Spinach	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20000769	AW1751	KENNER RANCH	Greenfield	310	0	ROW	Lettuce, Leaf	Onion, Dry	Broccoli	DIAZINON, CHLORPYRIFOS	2
20000778	AW1751	PURA RANCH 8	Greenfield	46	0	ROW	Carrot	Broccoli	Bean, Dried	DIAZINON, CHLORPYRIFOS	2
20000783	AW1751	GREENFIELD RANCH	Greenfield	108.5	0	ROW	Lettuce, Leaf	Carrot	Broccoli	DIAZINON, CHLORPYRIFOS	2
20007181	AW1754	spence ranch	salinas	235.8		ROW	Lettuce, Head	Cauliflower			2
20003831	AW1755	Clausen Ranch	San Ardo	117	0	ROW	Bean, Dried	Carrot	Onion, Dry		2
20007215	AW1756	Heess Ranch	Salinas	200	150	ROW	Lettuce, Head	Broccoli	Peas		2
20004136	AW1757	Martin Ranch	Castroville	68.5	0	ROW	Brussel Sprout	Artichoke		DIAZINON, CHLORPYRIFOS	2
20004130	AW1757	Lyons Ranch	Castroville	171	0	ROW	Brussel Sprout	Artichoke		DIAZINON, CHLORPYRIFOS	2
20004124	AW1757	Condor Ranch	Castroville	247.3	247.3	ROW	Brussel Sprout	Artichoke		DIAZINON, CHLORPYRIFOS	2
20000957	AW1758	Home Ranch	Nipomo	190		ORCHARD	Lemon	Avocado			2
20000956	AW1758	Wiliams	Nipomo	65		ORCHARD	Lemon				2
20000949	AW1758	Stinehart Ranch	Goleta	45		ORCHARD	Lemon	Avocado			2
20003644	AW1761	Blanco Ranch	Salinas	92.9	92.9	ROW	Lettuce, Head	Cauliflower	Lettuce, Leaf		2
20003646	AW1761	Boccardo Ranch	Castroville	134	0	ROW	Lettuce, Leaf	Spinach	Artichoke		2
20002894	AW1761	Morisoli Ranch	Gonzales	128.4	0	ROW	Lettuce, Head	Spinach	Cauliflower		2
20002966	AW1761	Petersen Ranch	Salinas	377.4	74.5	ROW	Lettuce, Head	Spinach	Cauliflower		2
20002975	AW1761	North Martin Ranch	Salinas	76.5	0	ROW	Artichoke				2
20002973	AW1761	Old Stage Ranch	Chualar	91	40	ROW	Lettuce, Head	Broccoli	Spinach		2
20002963	AW1761	Jack Chin	SAlinas	70.1	0	ROW	Lettuce, Head	Broccoli	Celery		2
20002892	AW1761	Martin Ranch	Salinas	411.7	0	ROW	Lettuce, Head	Artichoke	Spinach		2
20003654	AW1761	Boronda Ranch	Salinas	205.7	0	ROW	Artichoke	Lettuce, Leaf	Spinach		2
20003640	AW1761	Backus Ranch	Salinas	82.8	0	ROW	Lettuce, Leaf	Spinach	Cauliflower		2
20003661	AW1761	Hunter Lane Ranch	Salinas	325.8	0	ROW	Lettuce, Head	Artichoke	Cauliflower		2
20003691	AW1761	Jacop Ranch	Salinas	81.6	0	ROW	Lettuce, Head	Cauliflower	Artichoke		2

20003700	AW1761	Midway Ranch	Salinas	142	80	ROW	Lettuce, Head	Cauliflower	Artichoke		2
20003705	AW1761	Molera Ranch	Castroville	412.2	412	ROW	Lettuce, Head	Artichoke	Spinach		2
20003652	AW1761	Boggiatto Ranch	Castroville	221.1	87	ROW	Lettuce, Leaf	Cauliflower	Artichoke		2
20003712	AW1761	Twin Bridges Ranch	Castroville	76.1	52	ROW	Lettuce, Head	Artichoke	Cauliflower		2
20003637	AW1761	Agostini Ranch	Salinas	95.6	0	ROW	Lettuce, Head	Lettuce, Leaf	Spinach		2
20003694	AW1761	Lauritson Ranch	Salinas	173.5	40	ROW	Lettuce, Head	Lettuce, Leaf	Cauliflower		2
20003709	AW1761	Pieri Ranch	Castroville	103.5	0	ROW	Lettuce, Leaf	Cauliflower	Spinach		2
20004005	AW1764	JACKS AND HANSEN RANCH	SALINAS	225	225	ROW	Strawberry				2
20004086	AW1765	Ranch 15	Guadalupe	200	200	ROW	Broccoli	Lettuce, Head	Celery		2
20004083	AW1765	Ranch 11	Guadalupe	121	121	ROW	Broccoli	Celery			2
20004101	AW1765	Ranch 14	Santa Maria	87	87	ROW	Cauliflower	Broccoli	Lettuce, Head		2
20004099	AW1765	Ranch 8	santa maria	80	80	ROW	Broccoli	Lettuce, Head	Cauliflower		2
20004085	AW1765	Ranch 5	Guadalupe	260	260	ROW	Broccoli	Cauliflower	Celery		2
20004094	AW1765	Ranch 7	Santa Maria	66	66	ROW	Broccoli	Lettuce, Head	Cauliflower		2
20004093	AW1765	Ranch 2	Santa Maria	87	87	ROW, NURSERY	Broccoli	Lettuce, Head	Cauliflower		2
20004097	AW1765	Ranch 9	Santa Maria	80	80	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20004088	AW1765	Ranch 1	Santa Maria	82.5	82.5	ROW	Broccoli	Lettuce, Head	Cauliflower		2
20004089	AW1765	Ranch 3	Santa Maria	147	147	ROW	Broccoli	Lettuce, Head	Cauliflower		2
20003580	AW1767	Crosetti Ranch	Watsonville	59	118	ROW	Strawberry				2
20003699	AW1770	Home	Salinas	415.1	0	ROW	Lettuce, Head	Cauliflower	Broccoli	DIAZINON, CHLORPYRIFOS	2
20003706	AW1770	Secondo Ranch 2	Salinas	160.7	0	ROW	Lettuce, Head	Cauliflower	Broccoli	DIAZINON, CHLORPYRIFOS	2
20007293	AW1771	6425 Casitas Pass Road	Carpinteria	38	0	ORCHARD	Avocado				2
20003049	AW1774	USDA Agricultural Research Service	Salinas	144	0	ROW	Strawberry	Lettuce, Leaf	Broccoli		2
20007832	AW1776	Durley, Mclanahan, Ainscough Lease	Santa Maria	127.83	127.83	ROW	Lettuce, Leaf	Carrot	Cabbage		2
20005047	AW1776	Ranch #2	Santa Maria,	186.28	186.28	ROW	Lettuce, Leaf				2
20005160	AW1776	Ranch #5	Santa Maria	92.93	0	ROW	Lettuce, Leaf				2
20005138	AW1776	Preisker Estate	Santa Maria	403.91	403.91	ROW	Lettuce, Leaf	Carrot	Cabbage		2
20005200	AW1776	Ranch #64	Los Alamos	61	61	ROW	Lettuce, Leaf				2
20005187	AW1776	Ranch #6	Santa Maria	57	57	ROW	Lettuce, Leaf	Squash			2
20001070	AW1777	Voelker Ranch	Greenfield	232	0	ROW, NURSERY	Broccoli	Onion, Dry			2
20001074	AW1777	Mathias Ranch	Solodad	190	0	ROW, NURSERY	Broccoli	Carrot	Tomato		2
20000967	AW1780	SPIEGL HIGASHI	SALINAS	126.7	126.7	ROW	Broccoli	Lettuce, Head	Cauliflower		2
20006220	AW1780	WEAVER	CASTROVILLE	222.7	222.7	ROW	Lettuce, Head	Broccoli	Lettuce, Leaf		2
20000972	AW1780	BROOME HIGASHI	CHUALAR	141.7	0	ROW	Lettuce, Head	Onion, Green	Lettuce, Leaf		2
20000974	AW1780	BLANCO HIGASHI	SALINAS	135.6	135.6	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		2
20000975	AW1780	NASHUA HIGASHI	SALINAS	64.5	64.5	ROW	Strawberry	Onion, Green	Lettuce, Head		2
20000977	AW1780	SILACCI HIGASHI	SALINAS	89.2	89.2	ROW	Lettuce, Head	Broccoli	Cauliflower		2
20000548	AW1780	Daley Higashi Ranch WIDA 3 27A002509	Chualar	123	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		2
20013322	AW1780	Conley	Castroville	149.67	149.67	ROW	Lettuce, Head	Broccoli	Cauliflower		2
20011142	AW1780	BAILEY	CASTROVILLE	138	138	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		2
20000973	AW1780	HOME CARR LAKE	SALINAS	162.3	162.3	ROW	Broccoli	Celery	Onion, Green		2
20007356	AW1781	PEREZ FARMS	WATSONVILLE	17		ROW	Blueberry	Raspberry	Strawberry		2
20007376	AW1788	Triple A Avocados	Carpinteria	7	0	ORCHARD	Avocado				2
20000518	AW1793	Meyers	King City	420.3	0	ROW	Cauliflower	Cabbage	Lettuce, Head	DIAZINON, CHLORPYRIFOS	2
20000523	AW1793	Turri	King City	174.1	0	ROW	Lettuce, Leaf	Lettuce, Head	Onion, Dry	DIAZINON, CHLORPYRIFOS	2
20000522	AW1793	Pozzi North	King City	140.4	0	ROW	Cauliflower	Carrot	Onion, Dry	DIAZINON, CHLORPYRIFOS	2
20000521	AW1793	Pozzi South	King City	167.2	0	ROW	Cabbage	Cauliflower	Onion, Dry	DIAZINON, CHLORPYRIFOS	2
20000520	AW1793	Lombardi	King City	164.8	0	ROW	Cauliflower	Cabbage	Onion, Dry	DIAZINON, CHLORPYRIFOS	2
20000519	AW1793	Johnson	King City	456.3	0	ROW	Cabbage	Cauliflower	Lettuce, Head	DIAZINON, CHLORPYRIFOS	2
20000528	AW1793	Reynolds	King City	498	0	ROW	Lettuce, Leaf	Onion, Dry	Pepper, Fruiting	DIAZINON, CHLORPYRIFOS	2
20000526	AW1793	Lower (West) Doud	King City	452.5	0	ROW	Celery	Spinach	Broccoli	DIAZINON, CHLORPYRIFOS	2
20000515	AW1793	DaRosa	King City	377.3	0	ROW	Cauliflower	Cabbage	Lettuce, Head	DIAZINON, CHLORPYRIFOS	2
20000524	AW1793	Gill	King City	159	0	ROW	Cabbage	Cauliflower	Lettuce, Head	DIAZINON, CHLORPYRIFOS	2
20001046	AW1796	Soberanes	Soledad	39.17		VINEYARD					2
20001043	AW1796	Gary's Vineyard	Soledad	51.7		VINEYARD					2
20001017	AW1796	Rosella's Vineyard (previously knows as Gonzales Hill Ranch)	Soledad	77.4	0	VINEYARD, ORCHARD	Grapes, Wine	Lemon			2
20008762	AW1804	Porto-LCS	Gonzales	226.45	0	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20000883	AW1804	Blair-Sciaroni	Soledad	139.7	0	ROW	Lettuce, Head	Broccoli	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20013342	AW1804	Vaughn Ranch	Salinas	100.2	0	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20004184	AW1804	Sciaroni	Soledad	139.7	0	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20004193	AW1804	McDougall Ranch	Salinas	73	11.5	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20004188	AW1804	Morisoli and Salmina Ranches	Soledad	299	0	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20004190	AW1804	Doud Ranch	Soledad	326	54	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2

20004182	AW1804	Home and Sargenti Ranches	Gonzales	342	45	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20004175	AW1804	Blair and Handley Ranches	Soledad	477	0	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20008243	AW1805	COOPER	SALINAS	81.7	81.7	ROW	Strawberry				2
20008227	AW1805	VIERRA	SALINAS	61.1	61.1	ROW	Strawberry				2
20008224	AW1805	FISCALLINI	SALINAS	158.7	158.7	ROW	Strawberry	Lettuce, Head	Broccoli		2
20008238	AW1805	MERRILL MOLERA	CASTOVILLE	117	117	ROW	Strawberry				2
20008242	AW1805	BAILLIE	CASTROVILLE	63.3	63.3	ROW	Strawberry				2
20008223	AW1805	NISSEN	SALINAS	84	84	ROW	Strawberry				2
20008234	AW1805	SCHOOL HOUSE	SALINAS	55	55	ROW	Strawberry				2
20008225	AW1805	SIMON	SALINAS	59.5	59.5	ROW	Strawberry				2
20008235	AW1805	BALESTRA	SALINAS	68	68	ROW	Strawberry	Cauliflower			2
20008241	AW1805	SALINAS HILLTOP	PAJARO	54	54	ROW	Strawberry				2
20008229	AW1805	BORONDA	SALINAS	71.3	71.3	ROW	Strawberry				2
20001166	AW1807	Abrams Ranch	Salinas	223.1	50.2	ROW	Broccoli	Cabbage	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20001162	AW1807	Brun Ranch	Salinas	142.8	0	ROW	Broccoli	Lettuce, Head	Cauliflower	DIAZINON, CHLORPYRIFOS	2
20001154	AW1807	Hunter Lane	Salinas	109.2	0	ROW	Broccoli	Lettuce, Head	Cauliflower	DIAZINON, CHLORPYRIFOS	2
20001183	AW1807	Jensen Ranch	Salinas	438	438	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20004057	AW1810	Silva Home Ranch	Salinas	58.8	0	ROW	Celery	Broccoli	Lettuce, Leaf		2
20004067	AW1810	Zabala Ranch	Salinas	86.83	44.33	ROW	Celery	Broccoli	Lettuce, Leaf		2
20007333	AW1814	Ranch 2	Santa Cruz	104	104	ROW	Brussel Sprout			CHLORPYRIFOS	2
20007312	AW1814	Ranch 6	Moss Landing	243	160	ROW	Lettuce, Head	Brussel Sprout	Strawberry		2
20007311	AW1814	Ranch 1	Moss Landing	130	40	ROW	Brussel Sprout	Lettuce, Head	Strawberry	DIAZINON	2
20007317	AW1814	Lyons Ranch	Castroville	91	91	ROW	Broccoli	Brussel Sprout	Strawberry	CHLORPYRIFOS	2
20007314	AW1814	Springfield Home Ranch	Moss Landing	112.4	112.4	ROW	Lettuce, Head	Brussel Sprout	Spinach	DIAZINON	2
20007325	AW1814	Ranch 3	Moss Landing	137	137	ROW	Lettuce, Head	Brussel Sprout	Strawberry		2
20007323	AW1814	Ranch 1 Dominic's	Moss Landing	35	35	ROW	Brussel Sprout	Lettuce, Head	Strawberry	DIAZINON	2
20007328	AW1814	Dolan Road	Moss Landing	215	100	ROW	Brussel Sprout	Strawberry			2
20007334	AW1814	Ranch 8	Santa Cruz	71	71	ROW	Artichoke	Brussel Sprout		CHLORPYRIFOS	2
20007313	AW1814	Ranch 5	Moss Landing	210.5	105	ROW	Lettuce, Head	Brussel Sprout	Strawberry	DIAZINON	2
20007322	AW1814	Miranda	Moss Landing	32	32	ROW	Lettuce, Head	Spinach	Brussel Sprout	DIAZINON	2
20007327	AW1814	Moresco	Moss Landing	60	60	ROW	Lettuce, Head	Brussel Sprout	Strawberry		2
20005722	AW1815	Scattini Ranch	Greenfield	90	0	ROW	Broccoli	Cabbage	Lettuce, Head		2
20003546	AW1817	Park	Salinas	28	28	ROW	Artichoke				2
20003496	AW1817	Alisal	Salinas	101.7	0	ROW	Celery	Lettuce, Head	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20003540	AW1817	Whitman	San Ardo	400	106	ROW	Carrot	Onion, Dry	Bean, Dried	DIAZINON, CHLORPYRIFOS	2
20003487	AW1817	Jimmy Lyons	Salinas	175	90.5	ROW	Cauliflower	Broccoli	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20003498	AW1817	Armstrong	Salinas	49.8	49.8	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20008572	AW1817	Hurley	Castroville	80	80	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20003548	AW1817	Ricca	Salinas	53	53	ROW	Lettuce, Leaf	Cauliflower	Broccoli	DIAZINON, CHLORPYRIFOS	2
20013182	AW1817	Alexander/Borchard	Salinas	100	37.2	ROW	Other	Lettuce, Head	Broccoli		2
20003524	AW1817	Marvin	Salinas	72	72	ROW	Artichoke				2
20003502	AW1817	Home	Salinas	216.9	0	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20003500	AW1817	Brandt	San Ardo	161	161	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20003518	AW1817	Conlan	Salinas	185	185	ROW	Artichoke	Lettuce, Leaf	Broccoli	DIAZINON, CHLORPYRIFOS	2
20007464	AW1819	Hayes	Watsonville	100	15	ROW	Lettuce, Leaf	Mustard			2
20007451	AW1819	Bloomfield	Gilroy	271.6	50	ROW	Endive	Chinese Cabbage	Lettuce, Head	DIAZINON	2
20007446	AW1819	Merrill	King City	436.8	65	ROW	Broccoli	Celery	Lettuce, Head	DIAZINON	2
20007453	AW1819	Young	Gilroy	266.1	50	ROW	Spinach	Lettuce, Head	Mustard	DIAZINON	2
20007439	AW1819	Clement	King City	269.7	15	ROW	Chinese Cabbage	Endive	Broccoli	DIAZINON	2
20007436	AW1819	Home	Gonzales	360.1	16	ROW	Spinach	Broccoli	Cauliflower		2
20007443	AW1819	Coastal	King City	494.3	15	ROW	Celery	Lettuce, Head	Spinach	DIAZINON	2
20011484	AW1819	Las Colinas Ranch 3	San Lucas	219.03	1	ROW	Celery	Lettuce, Leaf	Mustard		2
20011922	AW1819	Santa Ana	Hollister	159.76	0.5	ROW	Broccoli	Cauliflower	Lettuce, Leaf		2
20011483	AW1819	Las Colinas Ranch 2	San Lucas	417.79	1	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20011485	AW1819	Las Colinas Ranch 4	San Lucas	300.79	1	ROW	Carrot	Lettuce, Head	Lettuce, Leaf		2
20011942	AW1819	Lightning Tree	Hollister	369.33	1.5	ROW	Lettuce, Leaf	Mustard	Spinach		2
20011482	AW1819	Las Colinas Ranch 1	San Lucas	464.02	1.5	ROW	Lettuce, Leaf	Mustard	Spinach		2
20007444	AW1819	Meyer	King City	66	2	ROW	Lettuce, Leaf	Spinach	Mustard		2
20007459	AW1819	Brown	Watsonville	63.6	2	ROW	Broccoli	Spinach	Lettuce, Leaf	DIAZINON	2
20007564	AW1820	Silva Farms Ranch 8	King City	290	0	ROW	Lettuce, Head	Broccoli	Spinach		2
20007563	AW1820	Home Ranch	Gonzales	90	90	VINEYARD, ORCHARD					2
20010582	AW1821	Balich	Watsonville	62	0	ROW	Strawberry	Strawberry			2
20001613	AW1823	Garlinger Ranch 171	Salinas	163.6	0	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf		2

Enrollment information in the Water Board's GeoTracker data management system as of Aug. 1, 2012.

20001619	AW1823	Corey Ranch Los Viboras	Salinas	190.5	52.8	ROW	Broccoli	Lettuce, Leaf	Lettuce, Head		2
20001612	AW1823	Chualar Ranch	Salinas	208.1	0	ROW	Broccoli	Lettuce, Leaf	Lettuce, Head		2
20001610	AW1823	Home Ranch GFLP	Salinas	138.3	138.3	ROW	Broccoli	Lettuce, Head			2
20001617	AW1823	Fennel Ranch	Salinas	68.6	0	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf		2
20001615	AW1823	McPherson Ranch	Salinas	273.4	0	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf		2
20013048	AW1823	Mortensen Ranch South	Salinas	309.4	0	ROW	Broccoli	Lettuce, Leaf	Lettuce, Head		2
20013091	AW1823	San Bernardo Ranch South	San Ardo	442.9	0	ROW	Lettuce, Leaf	Lettuce, Head	Spinach		2
20008556	AW1823	Cummings Ranch	Salinas	94.7	0	ROW	Broccoli	Lettuce, Leaf	Lettuce, Head		2
20008555	AW1823	Corey Ranch Marihart	Salinas	2	0	ROW	Broccoli	Lettuce, Leaf	Lettuce, Head		2
20008553	AW1823	Garlinger Ranch Front	Salinas	440.4	15.3	ROW	Broccoli	Lettuce, Leaf	Lettuce, Head		2
20008559	AW1823	Home Ranch Christensen	Salinas	103	103	ROW	Broccoli	Lettuce, Head			2
20008558	AW1823	Spence Ranch Azevedo	Salinas	101.6	65.2	ROW	Broccoli	Lettuce, Leaf	Lettuce, Head		2
20008557	AW1823	Spence Ranch Migotti	Salinas	94.2	47.1	ROW	Broccoli	Lettuce, Leaf	Lettuce, Head		2
20008554	AW1823	Corey Ranch Midnight Sun	Salinas	365.2	30.2	ROW	Broccoli	Lettuce, Leaf	Lettuce, Head		2
20004952	AW1827	Borba Farms	Aromas	20	0	ROW	Tomato	Pepper, Fruiting	Squash, Summer		2
20003478	AW1835	306 CARLTON	WATSONVILLE	18	18	ROW, ORCHARD	Blackberry	Lemon		DIAZINON	2
20003503	AW1835	371 CARLTON ROAD	WATSONVILLE	3	3	ROW	Blackberry			DIAZINON	2
20004604	AW1848	Evening Star Orchard	Goleta	8		ORCHARD	Avocado	Orange			2
20005442	AW1850	Cooper/Wineman	Santa Maria	58		ROW	Strawberry				2
20004874	AW1854	RANCH 2	LOMPOC	234	0	ROW	Broccoli	Bean, Dried	Lettuce, Head		2
20003773	AW1865	Soap Lake Ranch	Hollister	372		ROW	Lettuce, Leaf	Spinach			2
20007460	AW1869	Rincon Creek Farm	Carpinteria	1.5	0	ORCHARD	Avocado				2
20011585	AW1877	Sella - Dubach	Castroville	88.6	44.2	ROW	Lettuce, Head	Lettuce, Leaf	Spinach		2
20011582	AW1877	Molera - Preston	Castroville	202.7	202.7	ROW	Artichoke	Broccoli	Lettuce, Head		2
20002109	AW1877	Beach	Watsonville	259.8	259.8	ROW	Artichoke	Celery			2
20002102	AW1877	Bertelli	Castroville	170.2	170.2	ROW	Lettuce, Head	Lettuce, Leaf	Spinach		2
20002105	AW1877	Haymore	Salinas	168	168	ROW	Artichoke	Lettuce, Leaf	Broccoli		2
20011587	AW1877	Blackie	Castroville	229.2	57.3	ROW	Artichoke	Brussel Sprout	Broccoli		2
20011563	AW1877	Tottino	Salinas	97.8	97.8	ROW	Artichoke	Broccoli	Lettuce, Head		2
20011571	AW1877	San Jon - Martins	Salinas	123.3	41.1	ROW	Artichoke	Broccoli			2
20011568	AW1877	San Jon - Scilacci	Salinas	105.7	21.1	ROW	Artichoke	Broccoli	Lettuce, Leaf		2
20011566	AW1877	Espinosa	Salinas	124.9	45.6	ROW	Artichoke	Lettuce, Head	Broccoli		2
20011565	AW1877	Gularte	Salinas	317.8	97.2	ROW	Artichoke	Broccoli			2
20011562	AW1877	Nielsen - North	Castroville	192.4	146.7	ROW	Artichoke	Broccoli	Lettuce, Head		2
20011575	AW1877	M. Hill - S. Bellone	Castroville	235	117.5	ROW	Artichoke				2
20000842	AW1878	Viva Farms, Nipomo	Nipomo	4	4	NURSERY, GREENHOUSE				DIAZINON, CHLORPYRIFOS	2
20008564	AW1891	Cassidy Ranch	Aromas	67	67	ROW	Broccoli	Cauliflower	Lettuce, Leaf		2
20004495	AW1891	Delfino	Watsonville	73	73	ROW	Broccoli	Cauliflower	Lettuce, Leaf		2
20004485	AW1891	Cosmes Ranch	Watsonville	4	4	ROW	Squash, Summer	Celery	Leek		2
20004601	AW1891	Ring Ranch	Watsonville	29	29	ROW	Broccoli	Cauliflower	Cabbage		2
20004646	AW1891	St. Francis Ranch	Watsonville	9	9	ROW	Carrot	Radish	Spinach		2
20004649	AW1891	Seascape Ranch	La Selva Beach	63	63	ROW	Broccoli	Cauliflower	Lettuce, Leaf		2
20004562	AW1891	Matulich Ranch	Watsonville	170	170	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20004568	AW1891	Murphy Ranch	Watsonville	66	66	ROW	Broccoli	Cauliflower	Spinach		2
20004609	AW1891	Santa Maria Ranch	Watsonville	73	73	ROW	Lettuce, Leaf	Kale	Endive		2
20004521	AW1891	Lewis Ranch	Pajaro	27	27	ROW	Collard	Chinese Cabbage	Celery		2
20004518	AW1891	Lakeview Ranch	Watsonville	54	54	ROW	Beet	Lettuce, Head	Parsley		2
20004592	AW1891	Redman Ranch	Watsonville	41	41	ROW	Bean, Unspecified	Kale	Leek		2
20004514	AW1891	Kuso Ranch	Watsonville	16	16	ROW	Carrot	Radish	Parsley		2
20004517	AW1891	Lake Ranch	Watsonville	100	100	ROW	Peas	Squash, Summer	Lettuce, Leaf		2
20005781	AW1893	2	Las Lomas	1	0	ROW	Other				2
20007810	AW1894	H & K Berry Farm	Watsonvile	66	66	ROW	Strawberry				2
20004292	AW1900	J. H. Farms	New Cuyama, CA 93254	150	0	ROW	Other	Chinese Cabbage	Radish	DIAZINON	2
20001515	AW1901	Rainbow Bridge Ranch	Carpinteria	6	0	NURSERY					2
20004812	AW1902	Teixeira Ranch 15	Nipomo	404	404	ROW	Strawberry			CHLORPYRIFOS	2
20004814	AW1902	Teixeira Ranch 17	Guadalupe	202	202	ROW	Strawberry	Broccoli	Lettuce, Head	CHLORPYRIFOS	2
20004820	AW1902	Skillicorn Ranch	Watsonville	60	60	ROW	Strawberry			CHLORPYRIFOS	2
20001416	AW1919	Suey Ranch	Santa Maria	230	230	ROW	Endive				2
20002815	AW1927	Bruzzone Family Vineyards	Scotts Valley	7	0	VINEYARD	Grapes, Wine				2
20004394	AW1936	Hudson Ranch	Watsonville	39	39	ROW	Other				2
20004393	AW1936	Wesco Ranch	Watsonville	61	61	ROW	Strawberry				2
20004391	AW1936	Skillicorn 1-5	Watsonville	91	91	ROW	Other	Strawberry			2
20004390	AW1936	Wiley Ranch	Watsonville	41	41	ROW	Strawberry				2

20004401	AW1936	Cassin Ranch	Watsonville	71	71	ROW	Broccoli				2
20007871	AW1941	YI RANCH	NEW CUYAMA	497	0	ROW	Carrot	Onion, Dry	Potato		2
20004228	AW1942	CAMPINOTTI	Pescadero	189		ROW	Brussel Sprout	Leek	Other		2
20002596	AW1944	Dorcich Farms	Gilroy	45	0	VINEYARD					2
20002322	AW1946	Bay Laurel Nursery	Scotts Valley	3		NURSERY					2
20007454	AW1948	Fuji Lane Ranch	Salinas	16.29	0	NURSERY, GREENHOUSE	Broccoli	Tomato		DIAZINON, CHLORPYRIFOS	2
20007455	AW1948	Promesa Ranch	Nipomo	12.93	0	NURSERY, GREENHOUSE	Broccoli	Tomato		DIAZINON, CHLORPYRIFOS	2
20007452	AW1948	Pajaro Valley Ranch	Watsonville	18.92	0	NURSERY, GREENHOUSE	Broccoli	Tomato		DIAZINON, CHLORPYRIFOS	2
20007450	AW1948	Encinal 2	Salinas	10.66	0	NURSERY, GREENHOUSE	Broccoli	Tomato			2
20007441	AW1948	Espinosa Ranch	Salinas	30.35	30.35	NURSERY, GREENHOUSE	Broccoli	Tomato		DIAZINON, CHLORPYRIFOS	2
20007458	AW1948	Thompson Ranch	Nipomo	3.5	0	NURSERY, GREENHOUSE	Broccoli	Tomato		DIAZINON, CHLORPYRIFOS	2
20004791	AW1960	Brown Ranch	Aromas	96	0	ROW	Blackberry	Raspberry			2
20004760	AW1961	Chismahoo Piece	Ventura	10	10	ORCHARD					2
20004758	AW1961	Stanley Park	Ventura	7	7	ORCHARD					2
20004754	AW1961	Greentree Farm	Carpinteria	14	14	ORCHARD				CHLORPYRIFOS	2
20004764	AW1961	C&S 6 acres	Carpinteria	6	6	ORCHARD					2
20004756	AW1961	Folk's Piece	Carpinteria	5	5	ORCHARD					2
20003841	AW1969	Angelo P. Granaroli, Inc.	Carpinteria	21		ORCHARD					2
20000681	AW1976	Moran Nursery	Watsonville	2.5	2.5	NURSERY					2
20007184	AW1984	Bottiani	Goleta	55	0	ORCHARD	Lemon	Avocado		CHLORPYRIFOS	2
20007296	AW1990	The Stepladder Ranch	Cambria	45	0	ORCHARD	Avocado				2
20001618	AW1993	Nipomo	Nipomo	53	0	GREENHOUSE					2
20004483	AW2008	BARNARD RANCH	VE NTURA	13	0	ORCHARD	Avocado				2
20004548	AW2015	Uvas Creek Vineyards	Morgan Hill	8.5		VINEYARD					2
20004233	AW2020	Bardin	Salinas	118.8	0	ROW	Strawberry				2
20000464	AW2033	salvatore schettino	carpinteria	4.95		ORCHARD					2
20004792	AW2043	D'Arrigo Ranch #1	Spreckles	85	0	ROW	Strawberry				2
20007389	aw2046	denice farms [ben,s]	hollister	45	45	ORCHARD				DIAZINON	2
20007378	aw2046	abk	gilroy	90	90	ORCHARD				DIAZINON	2
20007387	aw2046	denice home ranch [al's]	hollister	28	28	ORCHARD				DIAZINON	2
20001540	AW3001	Kirkpatrick Orchard	Watsonville	54	54	ORCHARD	Apple			DIAZINON, CHLORPYRIFOS	2
20001541	AW3001	Amesti Orchard	Watsonville	157	0	ORCHARD				DIAZINON, CHLORPYRIFOS	2
20003794	AW3003	Ranch 3	Soledad	280		ROW	Broccoli	Lettuce, Leaf	Carrot	CHLORPYRIFOS	2
20003788	AW3003	Ranch 1	Greenfield	234		ROW	Broccoli	Lettuce, Leaf	Carrot		2
20008245	AW3008	Alfredo Pedroza	Gilroy	5	0	ROW	Cucumber				2
20000711	AW3016	Yamanishi Ranch	San Juan Bautista	37	0	ROW	Pepper, Fruiting	Lettuce, Head			2
20003971	AW3019	SANS RANCH	WATSONVILLE	2	0	ORCHARD	Apple				2
20003968	AW3019	HOME RANCH	WATSONVILLE	40	0	ORCHARD	Apple				2
20003963	AW3019	BURLAND RANCH	WATSONVILLE	14	0	ORCHARD	Apple				2
20002906	AW3020	Telephone Ranch	Santa Maria	80	1	ROW	Strawberry				2
20002867	AW3027	Amaral Ranches	San Lucas	200	200	ROW	Cabbage	Lettuce, Head	Broccoli		2
20006400	AW3029	Whiteside	Watsonville	40	40	ORCHARD				DIAZINON	2
20001971	AW3031	Guadalupe Ranch	Chualar CA	440	440	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf		2
20001933	AW3037	Zivanovich Ranch	watsonville	30.97	30.97	ORCHARD	Apple			DIAZINON	2
20001544	AW3053	RANCHO TARPEY	WATSONVILLE	7	7	ROW	Strawberry	Raspberry	Blackberry		2
20012922	AW3053	RANCHO SAN JUAN	AROMAS	6	6	ROW	Artichoke	Broccoli	Cauliflower		2
20007171	AW3057	Church Avocados	Carpinteria	0.5	0	ROW, ORCHARD	Avocado				2
20004474	AW3067	Soquel Nursery Growers, Inc.	Soquel	9	0	NURSERY, GREENHOUSE					2
20002227	AW3093	no ranch or farm name	Carpinteria	6	0	ORCHARD					2
20002941	AW3094	San Felipe Ranch	Gilroy	95		ORCHARD					2
20007665	AW3113	Jimenez Nursery	Carpinteria	12		NURSERY					2
20004800	AW3118	R.G. Thomsen Jr.	Soquel	2	0	NURSERY					2
20007893	AW3121	Sunbelt Ranch	San Juan Bautista	8	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	DIAZINON	2
20010082	AW3137	josef Meyr	Ventura , County	5	5	ORCHARD	Avocado	Citrus			2
20007639	AW3146	Garden Haven Nursery	Soquel	10	10	NURSERY, GREENHOUSE					2
20000931	AW3148	California Pajarosa	Watsonville	17	0	ROW, GREENHOUSE	Other			DIAZINON	2
20001562	AW3150	Home Ranch	Watsonville	20	0	ORCHARD					2
20001455	AW3155	Delk Ranch	Carpinteria	18	0	ORCHARD					2
20001720	AW3171	Lionello Orchids, Inc.	Carpinteria	2		GREENHOUSE				DIAZINON	2
20000871	AW3188	La Casita Ranch	Carpinteria, CA 93013	3.6	0	ORCHARD	Avocado				2
20007394	AW3190	Norman's Nursery Inc	Carpinteria	9	1	NURSERY					2
20003564	AW3197	Teixeira Ranch 2	Nipomo, CA	168	15	ROW	Strawberry	Lettuce, Head	Broccoli		2
20008163	AW3197	Teixeira Ranch 16	Guadalupe, CA	79.5	79.5	ROW	Strawberry				2

20003567	AW3197	Teixeira Ranch 7	Guadalupe	214	214	ROW	Lettuce, Head	Broccoli	Strawberry		2
20003569	AW3197	Teixeira Ranch 19	Guadalupe, CA	220	220	ROW	Strawberry	Lettuce, Head	Broccoli		2
20003571	AW3197	Teixeira Ranch 5	Guadalupe, CA	89	89	ROW	Broccoli	Lettuce, Head	Strawberry		2
20008842	AW3207	Evans Orchard	Hollister	4.5	0	ORCHARD				CHLORPYRIFOS	2
20007512	AW3210	Tony Daoiran	san luis obispo	13	0	ROW	Tomato	Carrot	Beet		2
20007366	AW3214	Robert M Swanson	Hollister	110	0	ROW, ORCHARD	Onion, Dry	Pumpkin	Squash		2
20004749	AW3217	Apricot Ranch	Gilroy	8	0	ORCHARD					2
20004913	AW3228	Garner Ranch	Soledad	5	0	ROW	Broccoli	Bean, Dried	Lettuce, Head		2
20012142	AW3232	Avila Valley Barn	San Luis Obispo	80		ROW, ORCHARD	Blackberry				2
20000563	AW3239	Sycamore Creek Vineyards & Winery	Morgan Hill	2.5	9	VINEYARD	Grapes, Wine				2
20004461	AW3254	Leonardini - River Ranch	Castroville	59	59	ROW	Strawberry				2
20000992	AW3259	Robert & Alice Swaim	Nipomo, CA 93444	9	0	ORCHARD				CHLORPYRIFOS	2
20009842	AW3264	Winchester Canyon Farms	Goleta	80		ROW	Beet	Tomato	Peas		2
20005118	AW3270	Ranch 4	Santa Maria	140	140	ROW	Lettuce, Head	Broccoli			2
20005336	AW3271	Vanoli Ranch	Greenfield	160	0	ROW	Lettuce, Leaf	Broccoli	Cauliflower		2
20005337	AW3271	Redding	Greenfield	229	0	ROW	Lettuce, Head	Carrot	Cauliflower		2
20005330	AW3271	Tavernetti Ranch	Gonzales	186	0	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20005325	AW3271	Turri	Chualar	432	0	ROW	Lettuce, Head	Broccoli	Carrot		2
20005333	AW3271	Pueblo Ranch	Greenfield	66	0	ROW	Cauliflower	Broccoli	Lettuce, Leaf		2
20005332	AW3271	Central Ranch	Greenfield	62	0	ROW	Carrot	Lettuce, Leaf	Broccoli		2
20005341	AW3271	Blomquist Ranch	Gonzales	198	0	ROW	Lettuce, Head	Cauliflower	Carrot		2
20005327	AW3271	Barrett	Gonzales	114	0	ROW	Lettuce, Leaf	Broccoli	Cauliflower		2
20005322	AW3271	Home Ranch 100	Gonzales	57	0	ROW	Lettuce, Head	Broccoli	Carrot		2
20005324	AW3271	Hartnell	Salinas	112	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		2
20005329	AW3271	Sharpe	Gonzales	158	0	ROW	Broccoli	Carrot	Lettuce, Leaf		2
20005540	AW3272	A ST/RANCHO GUADALUPE	SANTA MARIA	126	126	ROW	Strawberry				2
20004827	AW3275	Ranch 1	SLO county	133	0	ROW, VINEYARD	Broccoli	Cauliflower			2
20005054	AW3275	Ranch 16	Nipomo	86	0	ROW	Celery	Broccoli	Lettuce, Head		2
20004955	AW3275	Ranch 10	Santa Maria	106	0	ROW	Broccoli	Lettuce, Head	Cauliflower		2
20004864	AW3275	Ranch 2	Santa Maria	201	0	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20005016	AW3275	Ranch 14	Guadalupe	190	0	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20004895	AW3275	Ranch 4	Orcutt	138	0	ROW	Broccoli				2
20004898	AW3275	Ranch 5	Garry	327	0	ROW	Broccoli	Lettuce, Head	Celery		2
20004921	AW3275	Ranch 8	Santa Maria	137	0	ROW	Broccoli	Strawberry			2
20004947	AW3275	Ranch 9	Santa Maria	261	0	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20005040	AW3275	Ranch 15	Santa Maria	120	0	ROW	Strawberry	Cauliflower	Broccoli		2
20004907	AW3275	Ranch 6	Santa Maria	81	0	ROW	Broccoli	Strawberry	Cauliflower		2
20004977	AW3275	Ranch 12	Santa Maria	58	0	ROW	Cauliflower	Broccoli	Strawberry		2
20004876	AW3275	Ranch 3	Santa Maria	56	0	ROW	Celery	Lettuce, Head	Broccoli		2
20010282	AW3289	La Panza ranch	Creston	80	35	ROW, VINEYARD	Pepper, Fruiting				2
20005024	AW3301	Catlin Ranch	Carpinteria	24	24	ORCHARD	Avocado				2
20006300	AW3309	Catarino Chavez	santa maria	9	0	ROW	Strawberry	Broccoli	Cauliflower	DIAZINON, CHLORPYRIFOS	2
20001513	AW3313	Santa Cruz Olive Tree Nursery, Inc.	Watsonville	4	1.83	VINEYARD, NURSERY, ORCHARD	Olive				2
20003799	AW3318	18 acres RANCHO SAN JUAN -CORNER LUCY BROWN/SAN JUSTO	san juan bautista	18	0	ORCHARD	Apple				2
20003108	AW3335	McLellan Botanicals	Aromas CA 95004	155	123	ROW, NURSERY, ORCHARD, GREENHOUSE	Strawberry				2
20004676	AW3338	Ranch 1	Santa Maria	71	0	ROW	Lettuce, Head	Broccoli	Cauliflower		2
20004679	AW3338	Ranch 2	Santa Maria	268	0	ROW	Lettuce, Head	Broccoli	Cauliflower		2
20004692	AW3338	Ranch 3M	Santa Maria	69	0	ROW	Lettuce, Head	Broccoli	Cauliflower		2
20004699	AW3338	Ranch 4N	Santa Maria	76	0	ROW	Lettuce, Head	Broccoli	Cauliflower		2
20004697	AW3338	Ranch 4S	Santa Maria	123	0	ROW	Lettuce, Head	Broccoli	Cauliflower		2
20004412	AW3338	Ranch 5	Santa Maria	70	0	ROW	Lettuce, Head	Broccoli	Cauliflower		2
20004414	AW3338	Ranch 6S	Guadalupe	99	0	ROW	Lettuce, Head	Broccoli	Cauliflower		2
20004703	AW3342	Rodgers Ranch	Salinas	105	105	ROW	Strawberry				2
20004704	AW3342	Hambey Ranch	Salinas	70	70	ROW	Strawberry				2
20004698	AW3342	Strobel Ranch	Salinas	235	235	ROW	Strawberry				2
20003419	AW3400	Heess Ranch	Salinas	200	150	ROW	Lettuce, Leaf	Broccoli	Peas		2
20004686	AW3403	Ranch 4	Orcutt	102.78	102.78	ROW	Lettuce, Head	Broccoli	Cauliflower		2
20004685	AW3403	BP Ranch 2 & 5	Orcutt	317.45	317.45	ROW	Broccoli	Lettuce, Head	Cauliflower		2
20005940	AW3408	Bob Kuang Nursery	San Martin	3	0	GREENHOUSE					2
20004688	AW3414	Ranch 3	Guadalupe	90.98	90.98	ROW	Lettuce, Head	Broccoli	Cauliflower		2
20012542	AW3414	Ranch 7	Santa Maria	131.2	131.2	ROW	Broccoli				2
20004522	AW3415	South Wiley Ranch	Watsonville	27.5	27.5	ROW	Strawberry	Lettuce, Head			2
20004129	AW3427	Ed Clark	Carpinteria	7	0	ORCHARD					2

20004267	AW3428	Bengard Gambetta #2 Ranch	Salinas	43	43	ROW	Strawberry				2
20004482	AW3432	Zabala Ranch	Salinas	7	0	ROW	Blackberry				2
20004486	AW3432	Bungard Ranch	Salinas	37.5	0	ROW	Raspberry				2
20004470	AW3432	Lauritzen Ranch	salinas	55.4	0	ROW	Strawberry				2
20005208	AW3434	gary's farm	gilroy	4	0	GREENHOUSE					2
20004893	AW3441	Higaki Ranch	Watsonville	50	0	ROW	Strawberry				2
20004904	AW3441	Pedrazzi	Salinas	54	0	ROW	Strawberry				2
20003369	AW3443	HOLLISTER WALNUT RANCH SITE 2A	HOLLISTER	37.25	0	ROW	Tomato				2
20006480	AW3447	La Encantada	Lompoc	100	0	VINEYARD					2
20006080	AW3449	Lakeside Nursery	Salinas	10	10	NURSERY, GREENHOUSE					2
20004826	AW3451	Life's a Choke	San Luis Obispo	10		ROW	Other				2
20003561	AW3472	Overfelt	San Juan Bautista	20	0	ROW	Blackberry				2
20004343	AW3474	Airport	Salinas	63	0	ROW	Strawberry			DIAZINON	2
20007482	AW3474	Airport	Salinas	63	63	ROW	Strawberry			DIAZINON	2
20007403	AW3475	Mann	Watsonville	19.62	19	ROW	Strawberry			DIAZINON	2
20013102	AW3475	Jacks/Home	Salinas	76.12		ROW	Strawberry				2
20003284	AW3479	Sher J Wong Farm	Gilroy	5		GREENHOUSE	Chinese Cabbage	Other			2
20002133	AW3481	Silva Ranch LOVR LLC	Los Osos	20	0	ROW	Peas	Pepper, Fruiting			2
20005980	AW3482	Slo Creek Farms	San Luis Obispo	32	0	ROW, ORCHARD	Pumpkin				2
20004241	AW3485	Wilkinson Ranch	Watsonville	52	52	ROW	Blackberry	Raspberry			2
20003353	AW3486	Sweeney Vineyard	lompoc	4.5	0	VINEYARD					2
20003786	AW3495	Ranch 2	Nipomo	66	0	ROW	Strawberry				2
20008442	AW3495	Ranch 5	Nipomo	18	0	ROW	Strawberry				2
20008441	AW3495	Ranch 1	Nipomo	34	0	ROW	Strawberry				2
20004309	AW3501	Skilicorn Ranch	Watsonville	50	24	ROW	Strawberry				2
20003190	AW3502	ranch K2/ Jackson	Nipomo	210	0	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20012162	AW3502	ranch K4	Santa Maria	180	180	ROW	Broccoli	Peas	Cauliflower		2
20003986	AW3503	Tognetti	King City	182	40	ROW	Lettuce, Head	Spinach	Onion, Dry	CHLORPYRIFOS	2
20005043	AW3508	Ranch 12	Guadalupe	112	112	ROW	Strawberry				2
20005036	AW3508	Ranch 10	Santa Maria	125	125	ROW	Strawberry				2
20005027	AW3508	Ranch 1	Santa Maria	62.3	27.3	ROW	Strawberry				2
20007892	AW3514	Banovac Ranch	Watsonville	37	0	ROW	Raspberry				2
20007903	AW3514	Willoughby Molara Ranch	Castroville	60	0	ROW	Strawberry				2
20008185	AW3515	Porter Ranch	Watsonville	65	45	ROW	Blackberry	Raspberry	Strawberry		2
20008184	AW3516	Trafton Ranch	Watsonville	75	75	ROW	Strawberry				2
20007320	AW3520	Brothers	Los Olivos, Ca. 93441	65		ROW	Squash	Pepper, Fruiting	Broccoli		2
20007732	AW3526	BOGNUDA RANCH	SANTA MARIA	70	70	ROW	Strawberry				2
20012202	AW3526	West Porter	Santa maria	54	54	ROW	Strawberry				2
20007518	AW3531	Ivancovich Family Orchards	Hollister	15	0	ORCHARD					2
20007609	AW3537	Machado Creek Vineyards	Morgan Hill	8.5	0	VINEYARD, ORCHARD					2
20008283	AW3540	Octavio Garcia Farms	Salinas	4.75	0	ROW	Strawberry	Squash	Broccoli		2
20008082	AW3541	Bradley Ranch #3	santa maria	335	0	ROW	Broccoli	Strawberry	Squash		2
20007549	AW3544	HETTRICK	SALINAS	71.2	71.2	ROW	Lettuce, Head	Broccoli	Artichoke		2
20007548	AW3544	SAN JON	SALINAS	169.5	169.5	ROW	Lettuce, Head	Broccoli	Spinach		2
20007552	AW3544	SCHNEIDER	SALINAS	16	16	ROW	Lettuce, Head	Broccoli	Cauliflower		2
20007551	AW3544	GEARY LYONS	CASTROVILLE	57.2	57.2	ROW	Artichoke	Lettuce, Head	Cauliflower		2
20007553	AW3544	MARTIN	CASTROVILLE	61	61	ROW	Broccoli	Lettuce, Head	Cauliflower		2
20007547	AW3544	BORONDA	SALINAS	462	462	ROW	Lettuce, Head	Broccoli	Spinach		2
20007557	AW3544	MATHEW	CHULAR	91	0	ROW	Lettuce, Head	Broccoli	Spinach		2
20010224	AW3544	SARGENTI	GREENFIELD	126.3	0	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20010226	AW3544	MORGANTINI	GREENFIELD	76.13	0	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20010225	AW3544	REGAZZI	GREENFIELD	110	0	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20010223	AW3544	MASSA	SALINAS	66.9	0	ROW	Broccoli	Cauliflower	Lettuce, Head		2
20008052	AW3545	Rufoni Ranch	Santa Maria	74.5	74.5	ROW	Strawberry				2
20008051	AW3545	Telephone Ranch	Santa Maria	91	91	ROW	Strawberry				2
20008060	AW3545	Sutti Ranch, Lot 18	Santa Maria	108	108	ROW	Strawberry				2
20008061	AW3545	Robinson Ranch	Santa Maria	104	104	ROW	Strawberry				2
20007567	AW3553	Tarpey	Watsonville	60	0	ROW	Blackberry	Raspberry		DIAZINON	2
20007573	AW3553	Pista	Watsonville	17.22		ROW	Blackberry			DIAZINON	2
20007572	AW3553	Ryan	Castroville	65	0	ROW	Strawberry	Raspberry			2
20007570	AW3553	Silvestre	Watsonville Ca	12.5	0	ROW	Raspberry				2
20007569	AW3553	Allison	Watsonville	35		ROW	Blackberry	Raspberry			2
20007565	AW3553	Rockinoee	watsonville	88.3		ROW	Raspberry			DIAZINON	2

Enrollment information in the Water Board's GeoTracker data management system as of Aug. 1, 2012.

20008421	AW3554	Tung Woon Leung Nursery	San Martin	3	0	GREENHOUSE	Other				2
20008702	AW3558	TKS Ranch	Carpinteria	34	34	ORCHARD	Avocado				2
20009044	AW3559	Palmas	Salinas	21	0	ROW	Strawberry				2
20009042	AW3559	Bajo	Salinas	50	0	ROW	Strawberry				2
20009043	AW3559	Pozzi	Salinas	37	0	ROW	Raspberry	Strawberry		DIAZINON	2
20009282	AW3565	Stephen Leung Nursery	Gilroy	3	0	ROW	Other	Celery	Other		2
20003448	AW3566	pacific organics Inc.	Creston	87	1	ROW	Onion, Dry				2
20010504	AW3567	STONE RANCH	SANTA MARIA	263	263	ROW	Strawberry	Other			2
20009487	AW3568	Gubser Ranch (owned and farmed by Christopher Ranch, LLC	Gilroy	288.3	288.3	ROW	Other	Corn, Human Con.	Pepper, Fruiting	CHLORPYRIFOS	2
20010182	AW3570	Success Valley Farms LLC	Santa Maria	75	75	ROW	Strawberry			CHLORPYRIFOS	2
20010202	AW3570	Success Valley Farms LLC	Santa Maria	43	43	ROW	Strawberry			CHLORPYRIFOS	2
20010203	AW3570	Success Valley Farms LLC	NIPOMO	37	37	ROW	Strawberry			CHLORPYRIFOS	2
20009991	AW3573	Higuera Farms Inc.	Santa Maria	33	33	ROW	Strawberry			CHLORPYRIFOS	2
20009979	AW3573	Higuera Farms Inc	Santa Maria	40	40	ROW	Strawberry			CHLORPYRIFOS	2
20009990	AW3574	Savino Farms Inc.	Santa Maria	8	8	ROW	Strawberry			CHLORPYRIFOS	2
20009989	AW3574	Savino Farms Inc.	Santa Maria	26	26	ROW	Strawberry			CHLORPYRIFOS	2
20009978	AW3574	Savino Farms Inc.	Santa Maria	40	40	ROW	Strawberry			CHLORPYRIFOS	2
20009987	AW3575	Big F Company Inc.	Santa Maria	25	25	ROW	Strawberry			CHLORPYRIFOS	2
20009977	AW3575	Big F Company Inc.	Santa Maria	80	80	ROW	Strawberry			CHLORPYRIFOS	2
20009988	AW3575	Big F Company Inc.	Santa maria	10	10	ROW	Strawberry			CHLORPYRIFOS	2
20009981	AW3576	La Palma Farms Inc.	Santa Maria	60	60	ROW	Strawberry			CHLORPYRIFOS	2
20009985	AW3576	La Palma Farms Inc.	Santa Maria	40	40	ROW	Strawberry			CHLORPYRIFOS	2
20010863	AW3578	RIVER RANCH	Santa Maria	23	23	ROW	Strawberry			CHLORPYRIFOS	2
20011005	AW3578	Blosser Ranch	Santa Maria	40	40	ROW	Strawberry			CHLORPYRIFOS	2
20011662	AW3583	Herb Ranch	Hollister	3	0.5	ROW	Other				2
20012084	AW3584	Trafton	Watsonville	65.32	0	ROW	Strawberry				2
20012085	AW3584	Leonardi	Salians	102	0	ROW	Strawberry	Raspberry			2
20012283	AW3591	Boyd	Santa maria	34	34	ROW	Strawberry				2
20012183	AW3593	Phelps Ranch	Carpinteria	43	43	ORCHARD	Avocado				2
20012026	AW3598	Mt. Carmel	Lompoc	21	0	VINEYARD					2
20011962	AW3601	SWIFT RANCH COMPANY INC.	SANTA MARIA	65	65	ROW	Pepper, Fruiting				2
20011797	AW3603	SEBASTIAN Eade Ranch	San Ardo	76	0	ROW	Broccoli	Lettuce, Leaf	Spinach		2
20011794	AW3604	ASA Industrial Ranch	Soledad	31.9	0	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf		2
20011796	AW3604	ASA Eade Ranch	San Ardo	486	0	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf		2
20011793	AW3604	ASA Grisetti Ranch	Soledad	268.2	0	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf		2
20011792	AW3604	ASA Braga Home Ranch	Soledad	457	0	ROW	Broccoli	Lettuce, Leaf	Lettuce, Head		2
20011795	AW3604	ASA Vineyard Ranch	Soledad	254	0	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf		2
20011324	AW3605	Ranch 9	Nipomo	7	7	ROW	Strawberry			CHLORPYRIFOS	2
20011323	AW3605	Ranch 8	Nipomo	12	12	ROW	Strawberry			CHLORPYRIFOS	2
20011326	AW3605	Ranch 10	Nipomo	10	10	ROW	Strawberry			CHLORPYRIFOS	2
20011325	AW3605	Ranch 7	Nipomo	5	5	ROW	Strawberry			CHLORPYRIFOS	2
20011322	AW3605	HOME RANCH	Nipomo	13	13	ROW	Strawberry			CHLORPYRIFOS	2
20011882	AW3607	Creekside Floral	Carpinteria	4.5	0	GREENHOUSE	Other				2
20011862	AW3610	PROVIDENCE FARMS, LLC	SANTA MARIA	93.85	93.85	ROW	Blackberry	Strawberry	Raspberry		2
20013042	AW3619	Davis Ranch	Salinas	53.4	53.4	ROW	Strawberry				2
20013047	AW3621	Home	Salinas	53.5	0	ROW	Strawberry				2
20012722	AW3622	Harry a Giretti Farm	Gilroy	12	0	ORCHARD	Walnut				2
20003514	AW4503	Sea Smoke vineyard	Lompoc	105	0	VINEYARD					2
20003959	AW4547	Mahoney Brothers Inc. - Ranch #2	Santa Maria	125.2	125.2	ROW	Broccoli				2
20003956	AW4547	Mahoney Brothers Inc. -Ranch #1	Gudalupe	131.5	131.5	ROW	Lettuce, Head	Broccoli	Celery		2
20008603	AW4562	monterey bay farms llc	salinas	191	191	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		2
20001246	AW4562	massa ranch	salinas	119.5	119.5	ROW	Lettuce, Head	Lettuce, Leaf			2
20001206	AW4562	reeves ranch	salinas	197.8	0	ROW	Lettuce, Head	Lettuce, Leaf			2
20001225	AW4562	Harden ranch	salinas	100.3	0	ROW	Lettuce, Head	Lettuce, Leaf			2
20001232	AW4562	Bryggman ranch	salinas	87.5	87.5	ROW	Lettuce, Head	Lettuce, Leaf			2
20003162	AW4586	El Jabali	Buellton	6.6	0	VINEYARD					2
20003285	AW4589	Sanford Vineyard	Lompoc	139	0	VINEYARD					2
20010562	AW4608	ALFALFA CAMP RANCH	SANTA MARIA	50	0	ROW	Strawberry				2
20011982	AW4608	STONE RANCH	Santa Maria	55.15	0	ROW	Strawberry				2
20011984	AW4608	WHITE HILLS RANCH	Santa Maria	55	0	ROW	Strawberry				2
20001535	AW4608	WINEMAN RANCH	SANTA MARIA	110	110	ROW	Strawberry				2
20009402	AW4608	GRACIA RANCH	Santa Maria	70	0	ROW	Strawberry				2
20009422	AW4608	BATTLES RANCH	Santa Maria	52.15	0	ROW	Spinach				2

20007669	AW4608	COYOTE CREEK RANCH	SANTA MARIA	59.56	59.56	ROW	Strawberry				2
20007673	AW4608	KIM RANCH	SANTA MARIA	5	0	ROW	Strawberry				2
20007776	AW4608	HARRIS HILLS	LOS ALAMOS	60	0	ROW	Blackberry				2
20001210	AW4609	Lanini Ranch	Soledad	316.4	103.8	ROW	Broccoli	Lettuce, Leaf	Spinach	DIAZINON, CHLORPYRIFOS	2
20001205	AW4609	Home Ranch	Soledad	47.3	31.3	ROW	Broccoli	Lettuce, Leaf	Spinach	DIAZINON, CHLORPYRIFOS	2
20001207	AW4609	Roddick Ranch	Soledad	219.37	90.6	ROW	Broccoli	Lettuce, Leaf	Grapes, Wine	DIAZINON, CHLORPYRIFOS	2
20001221	AW4609	Bramers Ranch	Salinas	79.2	0	ROW	Broccoli	Lettuce, Head	Cauliflower	DIAZINON, CHLORPYRIFOS	2
20001231	AW4609	Luchessa Ranch	Soledad	108.5	0	ROW	Broccoli	Lettuce, Leaf	Cauliflower	DIAZINON, CHLORPYRIFOS	2
20001213	AW4609	Casacca Ranch	Soledad	58	0	ROW	Broccoli	Lettuce, Leaf	Spinach	DIAZINON, CHLORPYRIFOS	2
20001200	AW4609	Thompson Ranch	Soledad	51.4	51.4	ROW	Broccoli	Lettuce, Leaf	Spinach	DIAZINON, CHLORPYRIFOS	2
20001211	AW4609	Fanoe Ranch	Gonzales	280.9	173.9	ROW	Broccoli	Lettuce, Leaf	Celery	DIAZINON, CHLORPYRIFOS	2
20001196	AW4609	Salmina Ranch	Soledad	83.8	43.2	ROW	Broccoli	Lettuce, Leaf	Lettuce, Head	DIAZINON, CHLORPYRIFOS	2
20001233	AW4609	Rianda Ranch	Soledad	176.5	35.4	ROW	Broccoli	Lettuce, Leaf	Spinach	DIAZINON, CHLORPYRIFOS	2
20001278	AW4610	Bianco Ranch	Gonzales	53.3	22.4	ROW	Cauliflower	Lettuce, Leaf	Broccoli	DIAZINON, CHLORPYRIFOS	2
20001273	AW4610	Balemi Ranch Map	Soledad	88.3	69.2	ROW	Lettuce, Head	Lettuce, Leaf	Spinach	DIAZINON, CHLORPYRIFOS	2
20001270	AW4610	Lindstrand Ranch	Soledad	18.7	0	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20001275	AW4610	Barloggi Ranch	Soledad	131.3	31.8	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20001293	AW4610	Frolli Ranch	Soledad	60	0	ROW	Lettuce, Leaf	Broccoli	Spinach	DIAZINON, CHLORPYRIFOS	2
20001292	AW4610	Nelson Ranch	Soledad	18.8	0	ROW	Lettuce, Leaf	Lettuce, Head	Cauliflower	DIAZINON, CHLORPYRIFOS	2
20001290	AW4610	Radavero Ranch	Soledad	94.9	0	ROW	Lettuce, Leaf	Spinach	Cauliflower	DIAZINON, CHLORPYRIFOS	2
20001289	AW4610	Martignoni Ranch	Gonzales	120	0	ROW	Lettuce, Leaf	Broccoli	Cauliflower	DIAZINON, CHLORPYRIFOS	2
20001287	AW4610	Binsacca Ranch	Soledad	162.3	30	ROW	Lettuce, Head	Lettuce, Leaf	Cabbage	DIAZINON, CHLORPYRIFOS	2
20001285	AW4610	Daoro Ranch	Gonzales	85.3	41.7	ROW	Lettuce, Head	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20001283	AW4610	Mann/Yoder Ranch	Chualar	138.7	106.4	ROW	Celery	Broccoli	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20001279	AW4610	Vaughan Home Ranch	Soledad	57.5	0	ROW	Spinach	Lettuce, Leaf	Peas	DIAZINON, CHLORPYRIFOS	2
20001281	AW4610	Turri Ranch	Chualar	370.6	0	ROW	Broccoli	Lettuce, Leaf	Peas	DIAZINON, CHLORPYRIFOS	2
20001294	AW4610	Hidalgo Ranch	Soledad	14	0	ROW	Broccoli	Lettuce, Leaf	Peas	DIAZINON, CHLORPYRIFOS	2
20001286	AW4610	Silacci Ranch	Salinas	93.1	0	ROW	Lettuce, Head	Lettuce, Leaf	Cauliflower	DIAZINON, CHLORPYRIFOS	2
20001261	AW4610	Anderson Ranch	Soledad	52.4	52.4	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20001277	AW4610	Bassi Ranch	Gonzales	167.9	78.1	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20001272	AW4610	Violini Home Ranch	Soledad	18.1	0	ROW	Broccoli	Lettuce, Leaf	Peas	DIAZINON, CHLORPYRIFOS	2
20001265	AW4610	Madonna Ranch	Soledad	18.6	18.6	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	2
20004747	AW4611	Rancho Ancho Arena (RAA)	Arroyo Grande	190	0	ROW	Strawberry	Other		CHLORPYRIFOS	2
20003735	AW4616	Struve Ranch	Watsonville	60	40	ROW	Strawberry				2
20008525	AW4616	Petersen Ranch	Watsonville	71	0	ROW	Strawberry				2
20003736	AW4616	Anderson Ranch	Watsonville	66	30	ROW	Strawberry			DIAZINON	2
20003734	AW4616	Pekoch Ranch	Watsonville	62	62	ROW	Strawberry				2
20003834	AW4626	Gaver Ranch	Castroville	290	290	ROW, NURSERY	Strawberry	Broccoli	Peas		2
20004987	AW4629	Azevedo	Royal Oaks	35	0	ROW	Strawberry				2
20008366	AW4629	Ranch 12	Guadalupe	110	110	ROW	Strawberry				2
20007821	AW4629	Merrill Bardin Ranch	Salinas	156.2		ROW	Strawberry				2
20008365	AW4629	Ranch 10	Santa Maria	125	125	ROW	Strawberry				2
20007825	AW4629	Meridian	Castroville	57		ROW	Strawberry				2
20005721	AW0197	Rancho Sisquoc	Santa Maria	291	0	VINEYARD	Grapes, Wine	Grapes, Wine	Grapes, Wine		3
20010522	AW0204	Kantro	Chualar	619	18.7	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	3
20003194	AW0326	Jim Fanoe, Inc.	Salinas	700	700	ROW	Lettuce, Leaf	Broccoli	Spinach		3
20000614	AW0368	Sharer Brothers Farms	Santa Maria	210	10	ROW	Broccoli	Lettuce, Head	Strawberry		3
20004834	AW0368	Sharer Brothers Farms	Santa Maria	80	0	ROW	Broccoli	Strawberry	Lettuce, Head		3
20003936	AW0379	RANCH 21 (BOYD)	SANTA MARIA	127.62	0	ROW	Broccoli	Cauliflower	Strawberry	CHLORPYRIFOS	3
20003869	AW0379	RANCH 05 (BATTLES)	SANTA MARIA	215.25	74.43	ROW	Broccoli	Cauliflower	Strawberry	CHLORPYRIFOS	3
20003928	AW0379	RANCH 18 (SOARES)	SANTA MARIA	85.49	0	ROW	Broccoli	Cauliflower	Strawberry	CHLORPYRIFOS	3
20004154	AW0471	Christensen	Salinas	128.3	128.3	ROW	Broccoli	Lettuce, Head	Celery	DIAZINON, CHLORPYRIFOS	3
20001311	AW0549	Foothill, Simon, & Erro Dairy Ranches	Cuyama	561.35	80	ROW	Carrot	Bean, Unspecified			3
20001312	AW0549	Hub Russell Ranch SBC	New Cuyama	1249.14	40	ROW	Barley	Carrot			3
20002598	AW0550	Paicines	Paicines	464.1	464.1	ROW	Lettuce, Leaf	Broccoli	Cauliflower		3
20002586	AW0550	Farris	Hollister	466.8	466.8	ROW	Broccoli	Cauliflower	Lettuce, Leaf		3
20008445	AW0550	Wilson Ranch 10	San Lucas	630.8	630.8	ROW	Lettuce, Leaf	Spinach	Lettuce, Head		3
20008433	AW0550	Pedersen Ranch 7	Chualar	517	402	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf		3
20002876	AW0681	Ranch 4 North	Gonzales	409.9	0	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	3
20002889	AW0681	Ranch 15	Salinas	322.7	0	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	3
20002905	AW0681	Ranch 26 South Reservoir	King City	339	0	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	3
20002900	AW0681	Davies 22	Salinas	263.8	208	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	3
20002885	AW0681	Ranch 11	Soledad	421.5	0	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	3

20002903	AW0681	Ranch 25 East	King City	466	0	ROW	Broccoli	Cauliflower	Lettuce, Leaf	CHLORPYRIFOS	3
20002884	AW0681	Ranch 10	Soledad	386.1	0	ROW, VINEYARD	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	3
20002886	AW0681	Ranch 12	Salinas	474.6	474.6	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	3
20002898	AW0681	Ranch 20	Castroville	115	107	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	3
20002870	AW0681	Ranch 1 North	Salinas	299.8	0	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	3
20002880	AW0681	Ranch 7	Gonzales	435.2	187	ROW	Broccoli	Cauliflower	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	3
20002651	AW0699	Ferry Morse Ranch	San Juan Bautista	822	822	ROW	Endive	Parsley	Tomato		3
20002664	AW0699	Firestone/Anderson-Fowler Ranches	Salinas	742	0	ROW	Broccoli	Cauliflower	Other		3
20003051	AW0706	Ranch 1 - Broome Ranch Conventional	Chualar	857	0	ROW	Broccoli	Lettuce, Head	Celery	DIAZINON, CHLORPYRIFOS	3
20003067	AW0706	Ranch 13 - Swale Ranch Conventional	Chualar	226	100	ROW	Strawberry	Broccoli	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	3
20004871	AW0730	San Juan Bautista	San Juan Bautista, Ca	5	0	NURSERY, GREENHOUSE	Tomato	Celery	Lettuce, Leaf		3
20005199	AW0765	Highway 25 Area	Hollister	1051	200	ROW	Onion, Dry	Tomato	Lettuce, Head		3
20005018	AW1181	Temple (4)	Oceano	24	7	ROW	Broccoli	Cauliflower	Lettuce, Head		3
20001449	AW1251	Gallup AND Stribling Orchids INC.	Carpinteria	26	0	ROW, GREENHOUSE	Other	Other	Other	DIAZINON	3
20004405	AW1304	Li Fong Farm	Gilroy	40		ROW	Chinese Cabbage			DIAZINON	3
20004440	AW1328	Tierrasol Farms, LLC.	Gilroy	508	379	ROW	Celery	Lettuce, Leaf	Other	DIAZINON	3
20004585	AW1343	East Site	Gilroy	97	1.21	ROW, GREENHOUSE	Corn, Human Con.	Pepper, Fruiting	Other	CHLORPYRIFOS	3
20003832	AW1477	Freeway	Castroville , CA	161.7	161.7	ROW	Lettuce, Head	Lettuce, Leaf		DIAZINON	3
20003846	AW1477	Rimassa	Watsonville, CA	29.6	29.6	ROW	Lettuce, Head	Lettuce, Leaf		DIAZINON	3
20003863	AW1477	First St	Watsonville, CA	29	29	ROW	Lettuce, Head	Lettuce, Leaf		DIAZINON	3
20003923	AW1477	Lights	Watsonville, CA	48	48	ROW	Lettuce, Head			DIAZINON	3
20004045	AW1477	Trafton #2	Watsonville, CA	104.1	104.1	ROW	Lettuce, Head	Cauliflower		DIAZINON	3
20003822	AW1477	Dethlefsen	Watsonville, CA	13	13	ROW	Lettuce, Head	Lettuce, Leaf		DIAZINON	3
20003796	AW1477	Cox	Watsonville, CA	29.9	29.9	ROW	Lettuce, Leaf	Lettuce, Head		DIAZINON	3
20004032	AW1477	Trafton #1	Watsonville, CA	227.1	227.1	ROW	Cauliflower	Lettuce, Head	Lettuce, Leaf	DIAZINON	3
20004964	AW1492	Lower Patrick Ranch	Salinas	499.4		ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		3
20004906	AW1492	McHarry Ranch	salinas	78.8		ROW	Lettuce, Head	Lettuce, Leaf	Cauliflower		3
20004885	AW1492	Hageman Ranch	Salinas	498.7	0	ROW	Lettuce, Leaf	Broccoli	Lettuce, Head		3
20003880	AW1494	Molera	Salinas	340.7	189.1	ROW	Lettuce, Head	Lettuce, Leaf	Strawberry		3
20003874	AW1494	Los Coches	Soledad	1251.5	112.5	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		3
20000632	AW1496	BELLA VISTA Row Crop	KING CITY	1524.1	0	ROW	Spinach	Lettuce, Leaf	Cabbage		3
20000626	AW1496	ROSENBERG	San Ardo	498	0	ROW	Spinach	Cabbage	Lettuce, Leaf		3
20000633	AW1496	BELLA VISTA VINEYARD	KING CITY	81.6	0	VINEYARD					3
20003777	AW1503	CAULEY RANCH	KING CITY	598.35	0	ROW	Broccoli	Mustard	Spinach		3
20010045	AW1523	Ferini/Vecchioli (2,3,62)	Santa Maria	621	186	ROW	Broccoli	Cauliflower	Lettuce, Head		3
20004507	AW1523	Betteravia Investments - Harris Ranch (31, 32, 33, 34, 35)	Los Alamos	693	208	ROW	Broccoli	Cauliflower	Lettuce, Head		3
20004603	AW1523	LeRoy (1,27,29)	Santa Maria	700	210	ROW	Broccoli	Cauliflower	Lettuce, Head		3
20005275	AW1524	chen	gilroy	267	0	ROW	Corn, Human Con.	Pepper, Fruiting	Tomato		3
20008538	AW1524	Del monte	Gilroy	67	0	ROW	Corn, Human Con.	Pepper, Fruiting	Tomato		3
20005279	AW1524	New Ranch	gilroy	63	0	ROW	Corn, Human Con.	Pepper, Fruiting	Tomato		3
20005278	AW1524	Bennie Gilroy	Gilroy	80	0	ROW	Corn, Human Con.	Pepper, Fruiting	Tomato		3
20005271	AW1524	WANG	GILROY	26	0	ROW	Corn, Human Con.	Pepper, Fruiting	Tomato		3
20012982	AW1551	GALVAN RANCH	MOSS LANDING, CA	19.1	0	NURSERY				CHLORPYRIFOS	3
20003338	AW1556	Borina	Watsonville	36	0	ROW	Strawberry	Raspberry		DIAZINON	3
20010425	AW1560	Gold Coast Farms Ranch 3	Guadalupe	170	170	ROW	Cauliflower	Broccoli			3
20000740	AW1561	glau ranch / ranch 16	san ardo	585	585	ROW	Lettuce, Head	Carrot	Spinach		3
20003253	AW1568	RANCH 20	GUADALUPE	758.2	537.3	ROW	Lettuce, Head	Broccoli	Celery		3
20002829	AW1571	SILVEIRA RANCH	GREENFIELD	129.2	0	ROW	Lettuce, Head	Lettuce, Leaf	Cauliflower	DIAZINON	3
20003124	AW1627	Abe Ranch	Salinas	37	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli		3
20003123	AW1627	Lanini	Salinas	30	0	ROW	Lettuce, Leaf	Lettuce, Leaf	Broccoli		3
20007541	AW1634	Romie Ranch	Chualar	536	0	ROW	Lettuce, Leaf	Spinach	Broccoli		3
20004231	AW1636	Major Farms, Inc.	Soledad	1838	0	ROW	Lettuce, Leaf	Carrot	Bean, Dried		3
20004621	AW1641	T&A-Jensen	Salinas	66.9	54.7	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	CHLORPYRIFOS	3
20004638	AW1641	Rossi-Spreckels	Salinas	602.4	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	CHLORPYRIFOS	3
20004626	AW1641	T&A-Mathews	Salinas	26.7	0	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	CHLORPYRIFOS	3
20004618	AW1641	T&A-Frank McFadden	Salinas	109.8	109.8	ROW	Lettuce, Head	Lettuce, Leaf	Broccoli	CHLORPYRIFOS	3
20002599	AW1647	Fujii1	Watsonville	8.7	8.7	ROW	Lettuce, Head	Celery	Broccoli	DIAZINON, CHLORPYRIFOS	3
20002574	AW1651	Wilson East	King City	347.9	0	ROW	Celery	Lettuce, Head	Spinach	DIAZINON, CHLORPYRIFOS	3
20001360	AW1683	Hacienda Ranch	King City	740.1	0	ROW	Broccoli	Peas	Lettuce, Head	DIAZINON, CHLORPYRIFOS	3
20005183	AW1730	Ranch 1,2,5	greenfield	422.5	0	ROW	Lettuce, Head	Spinach	Bean, Unspecified		3
20004286	AW1748	Arnold Ranch	Soledad	671.07	0	ROW	Broccoli	Cauliflower	Lettuce, Head	DIAZINON, CHLORPYRIFOS	3
20004301	AW1748	Violini Ranch	Salinas	43.8	0	ROW	Broccoli	Cauliflower	Lettuce, Head	DIAZINON, CHLORPYRIFOS	3
20004302	AW1748	Pryor Ranch	Soledad	874.58	0	ROW	Broccoli	Cauliflower	Lettuce, Head	DIAZINON, CHLORPYRIFOS	3

20004281	AW1748	Callaghan Ranch	Soledad	1054.42	0	ROW	Broccoli	Lettuce, Head	Cauliflower	DIAZINON, CHLORPYRIFOS	3
20004105	AW1765	Ranch 10	Santa Maria	568	568	ROW	Broccoli	Cauliflower	Lettuce, Head		3
20000527	AW1793	Upper (East) Doud	King City	598.4	0	ROW	Celery	Lettuce, Leaf	Cauliflower	DIAZINON, CHLORPYRIFOS	3
20004196	AW1804	Williams Ranch	Gonzales	1248	0	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	3
20004179	AW1804	Garin Ranch	Salinas	126.8	28	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	3
20004191	AW1804	O.C. Bardin Ranch	Salinas	264	242	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf		3
20001171	AW1807	Fanoe Brothers Ranch	Gonzales	700	142.3	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	3
20001178	AW1807	Johnson Ranch	Chualar	559.4	288.4	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	3
20001175	AW1807	Closter Ranch	Chualar	107.8	0	ROW	Broccoli	Lettuce, Head	Lettuce, Leaf	DIAZINON, CHLORPYRIFOS	3
20003543	AW1817	Strobel	castroville	101	101	ROW	Lettuce, Leaf	Broccoli	Cauliflower	DIAZINON, CHLORPYRIFOS	3
20007438	AW1819	Freyer	Gonzales	589	32	ROW	Brussel Sprout	Lettuce, Leaf	Spinach	DIAZINON	3
20007456	AW1819	Wikstrom	Watsonville	50.4	5	ROW	Lettuce, Leaf	Mustard	Lettuce, Head	DIAZINON	3
20001622	AW1823	San Bernardo Ranch North	San Ardo	462.3	0	ROW	Carrot	Oat	Tomato		3
20001616	AW1823	Mortensen Ranch North	Salinas	219.3	0	ROW	Broccoli	Lettuce, Leaf	Lettuce, Head		3
20011573	AW1877	M. Hill - H. Bellone	Castroville	61.7	46	ROW	Artichoke	Lettuce, Head			3
20004810	AW1902	Teixeira Ranch 09	Nipomo	187.4	187.4	ROW	Strawberry	Broccoli	Lettuce, Head	CHLORPYRIFOS	3
20004397	AW1936	Home Ranch	Watsonville	48	48	ROW	Strawberry	Raspberry	Blackberry		3
20004403	AW1936	Stella Ranch	Watsonville	39	39	ROW	Strawberry				3
20007449	AW1948	Encinal 1	Salinas	17.31	0	NURSERY, GREENHOUSE	Broccoli	Tomato		DIAZINON, CHLORPYRIFOS	3
20004757	AW1961	Pinehill Piece	Carpinteria	20	20	ORCHARD				CHLORPYRIFOS	3
20002874	AW3027	Braga Ranches	San Lucas	940	280	ROW	Lettuce, Head	Onion, Dry	Broccoli		3
20004237	AW3035	B & M Farms, Inc.	Guadalupe	259	259	ROW	Broccoli	Peas		CHLORPYRIFOS	3
20007890	AW3121	Avila Ranch	Salinas	6	6	ROW, GREENHOUSE	Lettuce, Head	Lettuce, Leaf	Broccoli	DIAZINON	3
20002221	AW3233	benito valley farm	hollister	110	0	ROW	Chinese Cabbage	Peas	Spinach	DIAZINON	3
20004690	AW3414	Ranch 1 & 2 (JECL)	Guadalupe	328.75	328.75	ROW	Lettuce, Head	Broccoli	Cauliflower		3
20004322	AW3475	Cooper	Salinas	78.35	0	ROW	Strawberry			DIAZINON	3
20010222	AW3544	HUDSON	SOLEDAD	582.5	0	ROW	Broccoli	Cauliflower	Lettuce, Head		3

Exhibit 7

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April 1, 2010

Mr. Roger Briggs
Executive Officer
Regional Water Quality Control Board, Central Coast
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Subject: Preliminary Draft Staff Recommendations for an Agricultural Order Conditionally Waiving Individual Waste Discharge Requirements for Discharges From Irrigated Lands

Dear Mr. Briggs:

Our firm represents the Grower-Shipper Association of Santa Barbara and San Luis Obispo Counties (GSA) in the Central Coast Regional Water Quality Control Board's (Central Coast Water Board) matter for adoption of new regulations pertaining to discharges from irrigated lands. On behalf of GSA, we have reviewed the Preliminary Draft Staff Recommendations for an Agricultural Order (Preliminary Draft Staff Report), the Preliminary Draft Order Agricultural Order No. R3-2010-00XX (Preliminary Draft Order), and other associated documents.

The GSA is a non-profit agricultural trade association organized in 1947 to promote the general welfare of the produce industry in Santa Barbara and San Luis Obispo Counties. The GSA has 135 members who farm vegetables and strawberries in the Santa Maria, Arroyo Grande, and Lompoc valleys of central California. The GSA estimates its members annually ship over 60 million cartons of produce representing approximately $500 million in gross sales. The GSA employs in the aggregate approximately 15,000 workers. The GSA and its members will be directly impacted by the proposed staff recommendations contained in the February 1, 2010 Preliminary Draft Order.

In general, the Preliminary Draft Order includes significant and prescriptive requirements that gravely impact growers and the agricultural industry in the Central Coast. The proposed requirements are not only unlawful but put Central Coast growers at a severe disadvantage in a very competitive marketplace. If the Preliminary Draft Order is adopted as is, many growers in the Central Coast will no longer be able to afford to grow vegetables in this region, and potentially in California. Considering the devastating impact that this Preliminary Draft Order would have on the region's economy, we encourage you to direct staff to rescind the Preliminary Draft Staff Report and Preliminary Draft Order in their entirety and instead enter into a constructive dialogue with the local agricultural community. To that end, the GSA supports the alternative agricultural proposal that has been submitted to the Central Coast Water Board under separate cover.

In the unfortunate event that the Central Coast Water Board staff proceed with recommending adoption of the Preliminary Draft Order, we submit the following significant comments on the Preliminary Draft Staff Report, Preliminary Draft Order, and associated documents.

As a preliminary matter, we must express our outrage with the tone and representation of information contained in the Preliminary Draft Staff Report. Never before have we experienced such biased hostility in a public document that should objectively explain the issue of concern and provide a well-balanced, rational basis for the requirement being proposed. Furthermore, the Preliminary Draft Staff Report makes blanket inflammatory statements but fails to provide any evidence to support staff's conclusion. For example, it states that because "evidence of on-farm improvements and reductions in pollution loading from farms is not required, . . .[it] therefore probably does not exist for most farms." (Preliminary Draft Staff Report, p. 7.) The statement implies that because reporting on-farm information is not required, farmers are not making on-farm improvements and reductions in pollutant loading. This type of a conclusion is unwarranted and not supported with any evidence. In fact, many growers in the Central Coast have changed cultural practices to better protect water quality. A lack of reporting such changes to the Central Coast Water Board in no way constitutes evidence that improvements are not being made.

We also take issue with the claim that "[t]he agricultural industry must implement the most effective management practices (related to irrigation, nutrient, pesticide and sediment management) that will most likely yield the greatest amount of water quality protection, and verify their effectiveness with on-farm data." (Preliminary Draft Staff Report, p. 7.) This statement is directly contrary to the legislative intent and purpose of the Porter-Cologne Water Quality Control Act (Porter-Cologne), Assem. Bill 413 Stats. 1969, ch. 482, codified at Water Code section 13000 et seq. Specifically, Porter-Cologne requires the Central Coast Water Board to regulate "to attain the highest water quality which is reasonable, considering all demands being made and to be made on those waters . . . ." (Wat. Code, § 13000.) Thus, any regulation of the agricultural industry must be reasonable considering a number of factors, including cost. Effectiveness alone is not a legal requirement in Porter-Cologne.

Additionally, the Preliminary Draft Order proposes to regulate agricultural discharges in a manner that far exceeds requirements imposed on municipal stormwater discharges subject to federal National Pollutant Discharge Elimination System (NPDES) permits. Agricultural discharges are specifically exempt from the NPDES permit provisions of the federal Clean Water Act (CWA), codified at 33 U.S.C. section 1251 et seq. (See 33 U.S.C. § 1342(l); CWA § 402(l); see also 40 C.F.R. § 122.3(e).) However, discharges from agriculture and municipal stormwater are similar in nature and include similar types of pollutants (e.g., pesticides, nutrients). Although subject to different regulatory schemes (i.e., CWA v. Porter-Cologne), it makes no sense to regulate agricultural discharges more prescriptively than discharges from municipal stormwater.

Specifically, the CWA requires controls on municipal stormwater discharges to reduce pollutants "to the maximum extent practicable." (See 33 U.S.C. § 1342(p); CWA § 402(p).) The CWA *does not* require municipal stormwater discharges to comply with water quality standards, nor does it require the application of effluent limitations to the discharge. (*Defenders of Wildlife v. Browner* (1999) 191 F.3d 1159, 1166.) Like CWA requirements for municipal stormwater, Porter-Cologne does not require agricultural discharges to meet water quality standards at the end of the field. With respect to adopting a waiver, the Central Coast Water Board is required to ensure that the waiver is "consistent with any applicable state or regional water quality control plan and is in the public interest." (Wat. Code, § 13269(a)(1).) The Water Quality Control Plan for the Central Coast Region (Basin Plan) indicates that the Central Coast Water Board is implementing controls on nonpoint source pollution through outreach, education, public participation, technical assistance, financial assistance, interagency coordination, demonstration projects, and regulatory activities such as imposing septic tank area prohibitions. (See Basin Plan at p. IV-42 (Sept. 8, 1994).) Further, the Basin Plan states agricultural wastewaters and the effect of agricultural operations are a result of land use practices. (See Basin Plan at p. IV-46.) Nowhere does the Basin Plan state that the Central Coast Water Board is required or encouraged to adopt permit conditions on agriculture which require irrigation runoff to meet water quality standards at the end of the field. Considering the economic impact that the Preliminary Draft Order will have on individuals and the region in general, and the lack of consistency with the Basin Plan, the Preliminary Draft Order fails to meet the requirements for adoption as expressed in Water Code section 13269 because it is not consistent with the Basin Plan or in the public interest.

As a final general comment, the Central Coast Water Board must comply with Water Code section 13141 by first amending the Basin Plan to estimate the total cost and potential sources of funding for such a program. (See Wat. Code, § 13141.) In their current form, neither the Preliminary Draft Staff Report nor the Preliminary Draft Order indicate that the Central Coast Water Board intends to adopt a Basin Plan amendment that estimates the total cost and potential sources of funding for such a program. Failure to adopt a Basin Plan amendment with this information in advance of adopting a new agricultural water quality program would violate Porter-Cologne. (See Memorandum to Roy C. Hampson, Executive Officer of the Lahontan Regional Water Quality Control Board from the Office of the Chief Counsel (Jan. 21, 1983, at p. 6).)

When Water Code section 13141 was amended to include requirements related to agricultural water quality control programs, it was clear that these requirements would be met before implementation of any such program, including the type and nature of programs identified in the Preliminary Draft Order. More specifically, the State Water Board stated in its Enrolled Bill Report to the Governor's office that "[t]his bill will not prevent implementation and enforcement of agricultural water quality control programs. It will require, however, that the State and Regional Boards consider, and include in the basin plans, an economic study of an agricultural water quality control program in terms of total cost estimate and potential sources of financing *before* implementing such a program." (See Enrolled Bill Report to SB 904 from State Water Resources Control Board at p. 1, emphasis added.) The purpose of this provision, and the State Water Board's reason for encouraging signature of the legislation, was further expressed as follows:

> This bill is consistent with existing SWRCB policy regarding regulation of agricultural wastewater discharges.
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> Agriculture is presently the largest user of the State's freshwater resources. The Board recognizes that in many instances discharges of agricultural wastewaters create water quality problems. However, the Board also recognizes that there are inadequate institutional, financial, and technological means at this time for the development and management of a comprehensive and effective agricultural water quality control program. While, in specific instances, agricultural discharges can and should be dealt with under existing law, long-term water quality problems, such as nonpoint source control and salinity control programs, represent more difficult problems and the costs associated with implementation of these programs can be enormous. *Therefore, it is the Board' policy that any agricultural water quality control program must be carefully examined and formulated before it is implemented, and the costs and sources of financing would be a material consideration before any decision is made*. (*Id*. at p. 2, emphasis added.)

In light of the requirements expressed in Water Code section 13141, and the clear intent with respect to application of these requirements, the Preliminary Draft Staff Report must reflect the Central Coast Water Board's obligation to pursue a Basin Plan amendment accordingly prior to adoption of the program described in the Preliminary Draft Order. Further, as indicated above, the Central Coast Water Board must materially consider the costs associated with the program prior to adoption. Thus, we encourage the Central Coast Water Board to immediately commence development of cost information.

I. The Terms and Conditions in the Preliminary Draft Order Exceed the Central Coast Water Board's Lawful Authority to Protect Water Quality

The Preliminary Draft Order consists of many different parts, all of which are objectionable. The actual "waiver" is set forth in the Preliminary Draft Order and consists of 25 pages and 141 findings. The inaccuracy and unlawfulness of the findings are too many to address here. Further, the findings express the same hostility and bias found in the Preliminary Draft Staff Report. As stated earlier, we find the tenor and tone of the staff recommendation to be completely offensive as it fails to review information objectively and fails to propose a reasonable program to control agricultural discharges. Additionally, the operative provisions of the Preliminary Draft Order contained in the various attachments are unlawful for many reasons, which are addressed below.

Attachment B to the Preliminary Draft Order, titled *Terms and Conditions for Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands* (Attachment B) contains most of the substantive provisions that would be applied to agricultural growers in the Central Coast Region. In general, Attachment B includes significant substantive provisions that exceed the Central Coast Water Board's legal authority to protect water quality. As indicated earlier, activities which may affect the quality of waters "shall be regulated to attain the highest water quality which is *reasonable*, considering all demands being made and to be made on those waters, ..." (Wat. Code, § 13000, emphasis added.) The Central Coast Water Board is required to conform to and implement these policies. (See Wat. Code, § 13001.) Significant provisions of Attachment B which fail to comply with the Legislature's intent, as well as other requirements in Porter-Cologne, include but are not limited to certain general provisions specified in Part A, certain discharge prohibitions in Part B, technical report requirements in Part C, management practice implementation requirements in Part E, groundwater protection requirements in Part F, and aquatic habitat protection requirements in Part G. Water quality standards identified in Part D are discussed with our comments on application of water quality objectives.

A. General Provisions – Part A

Part A provides general provisions with which growers would be required to comply. Failure to comply with the general provisions or any other provision in Attachment B may result in an enforcement action under the California Water Code. Enforcement under the Water Code may include the assessment of significant monetary penalties for failing to comply. Considering the potential impact that may result from a grower's inability to comply with the proposed conditions set forth in Attachment B, it is imperative that all of the terms and conditions be reasonable and feasible. Unfortunately, this is not the case. Many of the requirements expressed in Part A are not applicable to agricultural discharges, are inconsistent with Porter-Cologne, and/or are not reasonable.

For example, Part A would require dischargers to comply with the Basin Plan and all other applicable water quality control plans identified in Attachment A, *Applicable Water Quality Control Plans and Definitions for Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands* (Attachment A). (Attachment B at p. 52.) However, Attachment A identifies several plans and policies that are not applicable to discharges from agricultural operations. In particular, the following policies listed in Attachment A do not apply: *Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California*, *Water Quality Control Policy for Enclosed Bays and Estuaries of California*, *Sources of Drinking Water Policy* (except as incorporated directly into the Basin Plan), *Policy for Implementation of*

Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California, and *Water Quality Control Plan for Ocean Waters of California*.

In another example, Part A would require agricultural growers to not "(a) cause, (b) have a reasonable potential to cause, or (c) contribute to an excursion above or outside the acceptable range for any Regional, State or Federal numeric or narrative water quality standard . . . ." (Attachment B at p. 52.) The terms "cause," "have the reasonable potential to cause," "or contribute to an excursion" are legal terms used in the federal regulatory scheme for the application of water quality based effluent limitations to point sources subject to NPDES permit requirements. (See 40 C.F.R. § 122.44(d)(1)(i).) Such a requirement is inapplicable to agricultural discharges because discharges from agriculture are specifically exempt from the NPDES permit provisions of the CWA. (See CWA § 402(l); see also 40 C.F.R. § 122.3(e).)

Additionally, Part A would require irrigation water to be of a quality that complies with groundwater quality objectives at the time of application. (See Attachment B at p. 52.) Although the language used attempts to connect the requirement to excess irrigation water as it "enter[s] the ground," in reality the only way to "assure" protection is to control the quality of water used for irrigation. This requirement is unreasonable and inconsistent with Porter-Cologne because the use of water for irrigation is not a "discharge of waste."

The legislative history of Porter-Cologne indicates "[t]he discharge of waste does not take place while water is still being used to irrigate crops in the fields." (Report of the Assembly Committee on Water concerning Assem. Bill 413 (Assembly Report) at p. 3.) The Legislature also made the following clarification: "after the irrigation has taken place and after a subsequent discharge into a watercourse or other waters of the state of runoff water or return flows from the irrigated fields, it is not intended to limit the existing authority of the regional boards to issue waste discharge requirements that are needed to protect the quality of the waters of the state." (Assembly Report at p. 3.) The State Water Board's Office of Chief Counsel further explained "discharges of agricultural drainage which seep through the soil and reach groundwater come under the regulatory authority of the Regional Board." (Analysis of Legal Issues Raised by the San Joaquin River Basin Technical Committee, Prepared by Sheila K. Vassey, Office of Chief Counsel, State Water Resources Control Board (Feb. 1987, as amended April 1987) (Analysis) at p. 45.)

The Legislature has not defined what constitutes "agricultural drainage." The regulatory distinction between percolation from irrigation and agricultural drainage resulting in discharge is unclear. The State Water Board Office of Chief Counsel appears to support the argument that the discharge of agricultural drainage occurs after the drainage water has been collected and stored in a manner that then seeps through soil to reach groundwater. (Analysis at p. 45 ["[b]ecause irrigation return flows and agricultural drainage waters constitute waste, the discharge of these wastes into a disposal area or into receiving waters is subject to regulation if the discharge could affect either surface or groundwaters"].) Further, the State Water Board's regulations governing the appropriation of water rights specifically provide that "[n]o permittee shall be required to file a report of waste discharge pursuant to Section 13260 of the Water Code for percolation to the groundwater of water resulting from the irrigation of crops." (Cal. Code Regs., tit. 23, § 783.) Thus, the State Water Board does not consider the percolation of irrigation water to groundwater a "discharge of waste."

Based on the State Water Board's treatment of the distinction between percolation and discharge, agricultural activities subject to regional board authority for the protection of groundwater is limited to those activities that collect and store agricultural drainage water versus the application of water for irrigation that may percolate to groundwater. Thus, the Central Coast Water Board proposes to exceed its authority by requiring irrigation water to be of a quality sufficient to protect beneficial uses.

Part A also includes mandates for compliance that apply to more specific provisions contained in other parts of Attachment B (e.g., Farm Plans and monitoring requirements). Our concerns with these provisions are addressed below.

B. Discharge Prohibitions – Part B

Part B includes discharge prohibitions that exceed relevant provisions in Porter-Cologne. Porter-Cologne provides "[a] regional board, in a water quality control plan or in waste discharge requirements, may specify certain conditions or areas where the discharge of waste, or certain types of waste, will not be permitted." (Wat. Code, § 13243.) Porter-Cologne does not authorize a regional board to prohibit discharges as part of a waiver issued pursuant to Water Code section 13269. (Wat. Code, § 13269.)

Furthermore, the discharge prohibition provisions proposed undercut the primary purpose for adoption of a waiver, or any order for that matter. Waivers from waste discharge requirements and water discharge requirements in general are intended to ensure that discharges of waste are controlled to protect water quality considering the beneficial uses of waters of the state, and water quality objectives reasonably required for the purpose of protecting beneficial uses. (See Wat. Code, §§ 13263, 13269.) Part B would propose blanket prohibitions on any discharge that may violate applicable water quality standards. For example, provision 21 directly contradicts provision 4 in Part A. Provision 4 in Part A provides for a compliance schedule in which discharges may not violate water quality standards. In contrast, provision 21 in Part B constitutes a direct prohibition without any consideration or application of time schedules contained in the Preliminary Draft Order.

Other discharge prohibitions in Part B are unlawful because they are completely unrelated to the discharge of waste and outside the Central Coast Water Board's authority to regulate and protect water quality. In particular, provisions 27 and 31 would prohibit activities that are NOT a discharge of waste. Provision 27 would prohibit the use of fertilizers in excess of crop needs. The Central Coast Water Board has no authority to dictate or control the amount of fertilizer used by any grower. Furthermore, the Central Coast Water Board does not have the ability or expertise to determine if fertilizer application is in fact in excess of crop needs. As a practical matter, growers do not typically apply fertilizers in excess of crop needs because to do so is expensive and wasteful.

With respect to provision 31, the Central Coast Water Board is attempting to prohibit the degradation of habitat, which again exceeds the Central Coast Water Board's authority. Prohibiting activities that may degrade habitat is unrelated to a prohibition against a discharge of waste. Moreover, many of the activities identified in provision 31 are subject to review and regulation by the California Department of Fish and Game and its authority to regulate any activity that may substantially impact any bed, bank or channel of any stream. (See Fish & G. Code, § 16000 et seq.)

C. Technical Reports – Part C

According to Part C, the Central Coast Water Board is requiring technical reports pursuant to Water Code section 13267. The Central Coast Water Board's ability to require reports pursuant to this provision is not without constraints. In order for a section 13267 request to be upheld, the Central Coast Water Board has the burden of explaining to the discharger the need for the information and for identifying substantial factual evidence that supports requiring the reports, *i.e.*, demonstrates a nexus between the requested information and the Central Coast Water Board's statutory authority to investigate water quality. Mere assertions that such a nexus exists are insufficient to support a section 13267 request. Most of the technical report requests proposed in Part C, and the specific information required in Part E discussed in section I.D below, fail in whole or part to meet the Central Coast Water Board's statutory authority. Further, many of the technical report requirements include substantive provisions that exceed the Central Coast Water Board's authority.

1. Notice of Intent (NOI)

To be classified as a "Low-Risk Discharge," a grower would need to demonstrate in the NOI that all tailwater has been eliminated anad the farm is not within 1,000 feet of an impaired surface water body. Additionally, the NOI would need to demonstrate effective use of integrated pest management (IPM), a certified nutrient management plan and use of stormwater control measures. In this case, if the discharger is able to demonstrate that tailwater has been eliminated, there is no need for the discharger to provide information regarding location of the operation versus impaired water bodies. Also, the burden of demonstrating effectiveness of IPM and use of nutrient management plans bears no reasonable relationship to the Central Coast Water Board's need for the information.

For those that do not meet the eligibility requirements as a "Low-Risk Discharge," the NOI must include information regarding crops, chemical inputs used, irrigation system type, and nitrate concentrations in irrigation source water, among other things. In particular, the NOI would need to include an identification of "[c]hemicals applied in a manner that may result in the material coming in contact with irrigation water, stormwater, surface water, or groundwater[,]" and would require identification of "nitrate concentration in irrigation source water." (Attachment B at p. 58.) The request for this information does not meet the Central Coast Water Board's burden because the Central Coast Water Board has failed to explain how the burden of providing such information assists them in investigating water quality associated with "discharges of waste." For example, chemicals are often applied to crops through the irrigation system (i.e., chemigation). However, the use of chemigation does not mean that agricultural tailwater will in fact include concentrations of these chemicals in levels that will impact water quality standards, which are applicable to the receiving waters.[1] Thus, this information would provide the Central Coast Water Board with no real information regarding water quality levels in nearby waters of the state. In contrast, the burden of identifying all potential chemicals that might be used within the five-year term of the waiver by an ever-changing farming operation would be speculative, and leave the grower in peril if a chemical needed in five years was not identified with the original NOI.

Similarly, the Central Coast Water Board fails to properly support its request for nitrate concentrations in irrigation source water. The level of nitrate in irrigation source water does not necessarily predict the level of nitrate that may result in receiving waters due to discharges of agricultural waste. The cost of testing irrigation source water that may be used within the next five-year period, however, is unreasonable as compared to the usefulness of the information. Thus, the request for this information in the NOI does not satisfy the requirements specified in Water Code section 13267.

2. Farm Water Quality Management Plan (Farm Plan)

Under the Preliminary Draft Order, the required Farm Plan would need to identify certain types of management practices including the use of IPM. In fact, the Farm Plan would require a grower to maximize IPM practices. However, the Central Coast Water Board has no authority to mandate or require the use of IPM by individual growers. IPM is defined in Attachment A to mean a pest management strategy that focuses on long-term prevention or suppression of pest problems and uses pesticides only when necessary according to pre-established guidelines or treatment thresholds. (Attachment A at p. 33.) In other words, through the Farm Plan, the Central Coast Water Board is attempting to prohibit the use of pesticides except in accordance with IPM guidelines and treatment thresholds.

In California, pesticides are regulated by the California Department of Pesticide Regulation (DPR). (Food & Agr. Code, § 11454.) The DPR's primary purposes include (1) providing for the proper, safe, and efficient use of pesticides essential for production of food and fiber; (2) protecting public health and safety; (3) protecting the environment; (4) protecting agricultural and pest control workers; (5) assuring consumers and users that pesticides are properly labeled; and (6) encouraging the development and implementation of pest management systems that stress application of biological and cultural pest control

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[1] As discussed further in section II below, water quality standards apply to waters of the state, not tailwater leaving an agricultural property.

techniques with selective pesticides when necessary. (Food & Agr. Code, § 1501.) In 1984, the California Legislature declared that, "matters relating to (pesticides) are of a statewide interest and concern and are to be administered on a statewide basis by the state unless specific exceptions are made in state legislation for local administration." (Stats. 1984, ch. 1386.) To ensure that the state maintained sole jurisdictional authority over the regulation of pesticides, the California Legislature adopted a statute that vested complete control and regulation of pesticides including the registration, sale, transportation, or use of pesticides with the state, and the DPR in particular. (Food & Agr. Code, § 11501.1.)

Although the Central Coast Water Board is a state agency, it is not vested with the authority to regulate or restrict pesticide use by individuals. As the Food and Agricultural Code indicates, the DPR is vested with the authority to regulate and restrict the use of pesticides in California. The Central Coast Water Board's authority is limited to matters that pertain to water quality. (Wat. Code, § 13225.) It does not include the authority to direct growers with regard to its pesticide applications, storage and use records, or to direct the means to comply with a permit. Thus, the requirements in the Preliminary Draft Order that direct the growers to implement IPM practices are unlawful.

Additionally, Attachment B would require growers to submit the Farm Plans at any time, upon the request of the Executive Officer. (Attachment B at p. 60.) The burden of submitting Farm Plans, which will automatically make them public documents, does not bear a reasonable relationship to the Central Coast Water Board's need. Farm Plans contain significant amounts of proprietary information. Those individuals required to submit Farm Plans will be at a competitive disadvantage versus those that are not. In the meantime, the Central Coast Water Board has the authority to visit grower operations and review Farm Plans on-sight without requesting their submittal. Thus, the Central Coast Water Board is able to review Farm Plan content without placing an undue burden on some by requiring them to submit Farm Plans to a public agency thereby making public previously held proprietary information.

D. Management Practice Implementation Requirements – Part E

As discussed in part above, many of the Farm Plan requirements exceed the Central Coast Water Board's legal authority specified in Porter-Cologne. Part E provides further detail with respect to those Farm Plan requirements and therefore provides additional information to further support the fact that the Central Coast Water Board is attempting to place unlawful requirements on growers under the guise of protecting water quality. Applicable in all of the management practice implementation requirements is a prohibition of irrigation runoff from a farming operation that is "adjacent to, or in close proximity" of an impaired water body or a tributary to an impaired water body. (See Attachment B at pp. 62-65.) "Adjacent to or close proximity" is defined to mean within 1,000 feet. As stated previously, the Central Coast Water Board has the authority to place conditions on dischargers through waivers to protect beneficial uses and reasonable water quality objectives, however, the Central Coast Water Board has no authority to require the elimination of tailwater discharges altogether. Further, discharge prohibitions must be adopted as part of a water quality control plan or waste discharge requirements, and are limited in scope and area. (See Wat. Code, § 13243.) Defining "adjacent to or in close proximity" to mean 1,000 feet is unreasonable and hardly limited in scope and area. To put it into perspective, 1,000 feet exceeds the distance of three football fields. The Central Coast Water Board has provided no justification or evidence to support the need for a discharge prohibition within 1,000 feet of an impaired water body or its tributaries.

We address other specific management practice implementation requirements in more detail here.

1. Irrigation Management

Attachment B would require submittal of irrigation management information that exceeds the Central Coast Water Board's authority pursuant to Water Code section 13267. As discussed above, Water Code section 13267 requires that technical report information bear a reasonable relationship to the Central Coast Water Board's need for the information. Further, a regional board bears the burden of showing that the request is reasonable. Part E would require a Farm Plan to include in relevant part information regarding: type of irrigation system, distribution efficiency, and distribution uniformity; average total water demand per crop; total water applied per crop; and, schedule, duration, and frequency of irrigation waters. The burden on a grower to prepare and put forward this type of information in a Farm Plan for the Central Coast Water Board's purposes is significant. Specifically, agriculture is not a static endeavor that remains the same on an annual, or seasonal basis. Irrigation demand is constantly changing due to hydrology and crop needs. It is not possible for a Farm Plan that is supposed to be prepared prospectively to include the schedule, duration, and frequency of irrigation for any crop. Thus, to meet the Farm Plan requirements, growers will need to speculate on future irrigation schedules. In contrast, speculative information regarding irrigation schedules provides the Central Coast Water Board with no useful information regarding potential impacts to water quality.

In another egregious example, Attachment B would set minimum irrigation system distribution uniformity requirements. (See Attachment B at p. 62.) As explained previously, the Central Coast Water Board has the authority to place conditions on waste discharges to protect waters of the state, not dictate agricultural irrigation management. Further, this requirement violates Water Code section 13360, which prohibits the regional board from dictating the particular manner of compliance.

2. Pesticide Runoff/Toxicity Elimination

As indicated above, the Central Coast Water Board does not have the legal authority to require growers to implement IPM, or the legal authority to restrict the use of pesticides. However, the pesticide runoff and toxicity elimination management measures include requirements with respect to IPM and pesticide use restrictions that are outside the Central Coast Water Board's water quality authority. Specifically, Attachment B would require growers to use University of California IPM program guidelines and set buffers for pesticide applications. The use of IPM is voluntary and may not be mandated by the Central Coast Water Board, or for that matter, the DPR. More importantly, restrictions on the use of pesticides are solely within the DPR's legal authority. (Food & Agr. Code, § 11501.1.) Buffers are established on labels for specific pesticides, where appropriate. Moreover, the DPR is considering the adoption of *Restrictions to Address Pesticide Drift and Runoff to Protect Surface Water* (Surface Water Regulations).[2] In the draft Surface Water Regulations, DPR proposes to restrict ground applications of pesticides within 25 feet of any sensitive aquatic site. (See DPR's Draft Surface Water Regulations at § (a)(1).) Contrary to DPR's proposed regulations, the Central Coast Water Board proposes to limit ground applications of pesticides within 50 feet of *any* surface water body. (Attachment B at p. 64.) Regardless of the conflict, the Central Coast Water Board has no authority to restrict the use of pesticides in the manner proposed.

Further, the buffer requirements specified in Attachment B violate Water Code section 13360. As stated before, section 13360 prohibits the Central Coast Water Board from dictating the manner of compliance. In this case, Attachment B proposes to set forth specific prescriptions for which growers would need to comply. As such, the buffer requirements dictate the manner of compliance and are unlawful. (See *In the Matter of the Petition of the United States Department of Agriculture, Forest Service, etc.* (April 21, 1983) Order No. WQ 83-3, at pp. 4-6, State Water Board found certain best management practices to require dischargers to follow certain prescriptions and such prescriptions specified the manner of compliance in violation of Wat. Code, § 13360.)

3. Nutrient and Salt Management

The Central Coast Water Board proposes to regulate the use of fertilizers in a manner that far exceeds its authority to protect water quality. As stated previously in many ways, the Central Coast Water Board's authority to protect water quality is not without constraints. In general, Porter-Cologne requires a regional board to regulate in a manner that is reasonable, considering all the demands being placed on the water. Porter-Cologne also asserts that a regional board's request for technical information may not be unreasonable as compared to the burden of compiling the information, including cost. The proposed requirements related to nutrient and salt management clearly exceed any normal person's perception of what is reasonable.

For example, the nutrient management element of the Farm Plan must be approved by a Certified Crop Advisor, and would be required to include, in part, the following: (1) average total crop nutrient demand and method(s) of determination per crop; (2) average

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[2] DPR is currently holding workshops on the proposed regulations and anticipates submitting them to the Office of Administrative Law in June of 2010. For more information, visit http://www.cdpr.ca.gov/docs/emon/surfwtr/regulatory.htm.

total water demand per crop and total water applied per crop; (3) monthly record of fertilizer applications per crop; (4) nitrate concentration of irrigation source water; (5) timing of fertilizer application to maximize crop uptake; (6) estimation of the amount of fertilizer applied in excess of crop needs; and (7) estimation of excess or residual fertilizer/nutrients in the root zone at the end of the crop growing season. While most of this information may be useful to a grower for business purposes, this information provides no benefit to the Central Coast Water Board to determine if best management practices are being implemented to protect water quality. Further, the request to compile this information into a Farm Plan that may become a public document upon the Central Coast Water Board's request is unreasonable as compared to the burden on the individual grower. Not only is there the cost of having a Certified Crop Advisor prepare and certify the nutrient management element, but it also provides for public access to proprietary information.

With respect to salt management, the provisions in Attachment B are *not* consistent with the salt management provisions in the Basin Plan. For example, Attachment B would propose to eliminate the use of leaching to control salt in the soil profile. However, the Basin Plan provides that implementation of leaching with the use of low leaching fractions can be beneficial. (See Basin Plan at p. IV-48.) The Basin Plan also recognizes that with salts the issue is much larger to solve than can be accomplished on an individual farm basis, yet the Preliminary Draft Order fails to recognize the need to address the issue regionally. (See Basin Plan at p. IV-49 ["The off- farm part of drainage, however, is too big for individual farmers to solve, and some form of collective, organized large scale action is needed."].)

4. Aquatic Habitat Protection

As with the other management practice implementation requirements, the information requested in conjunction with the aquatic habitat protection element of the Farm Plan exceeds the Central Coast Water Board's authority to request information. The burden of preparing the information does not bear a reasonable relationship to the Central Coast Water Board's need for the information. For example, the Farm Plan would need to document a wetland area habitat. The term wetland is somewhat ambiguous and has yet to be defined by the State Water Board. The definition identified in Attachment A is a definition developed for the Technical Advisory Team for the California Wetland and Riparian Area Protection Policy. The document that discusses the definition states upfront that "[t]his is not a draft or final California state wetland definition. This is the wetland definition recommended by the Technical Advisory Team to the Policy Development Team for the California Wetland and Riparian Area Protection Policy." In other words, the definition is not one proposed or adopted by the State Water Board in any way. Thus, it is inappropriate for the Central Coast Water Board to use the definition here. Further, it is unreasonable to request growers to identify wetland areas when such a term is not currently defined by the State Water Board for water quality regulatory purposes. Considering the controversy surrounding what constitutes a wetland, such an exercise would be futile.

Moreover, the requirements specified in Part G for which implementation is required as part of the Farm Plan, are unlawful and must be removed. We provide more specific comments on Part G below.

E. Groundwater Protection Requirements – Part F

The Central Coast Water Board may not require dischargers to construct and maintain ponds, reservoirs, and other containment structures to avoid leaching of waste to groundwater. (See Attachment B at p. 69.) As discussed previously, prescriptive requirements such as these are considered to dictate the manner of compliance, which is unlawful. (See section I.D.2, *ante*.) With respect to provision 77, it is unnecessary for the Central Coast Water Board to identify actions that the Central Coast Water Board "might" take. In this provision, the Central Coast Water Board attempts to threaten growers by stating that the Executive Officer may require sampling of private wells pursuant to Water Code section 13267, however, the provision does not indicate under what circumstances the Executive Officer would issue such an order. As indicated above, the Central Coast Water Board's authority, as implemented here through the Executive Officer, is not without constraints. Before requiring a grower to conduct such sampling, the Executive Officer would need to provide sufficient evidence to show that the cost and burden of collecting the information was necessary for the Central Coast Water Board's purposes.

Provision 77 further attempts to threaten growers by stating that the Central Coast Water Board may require growers to provide alternative water supplies pursuant to Water Code section 13304. Unfortunately, the references to this authority are incomplete and fail to fully explain how the Central Coast Water Board might be able to require growers to provide alternative water supplies. Water Code section 13304 is an enforcement mechanism that allows regional boards to issue Cleanup and Abatement Orders where waste is, or probably will be, discharged into waters of the state, and threatens to create a condition of pollution or nuisance. As part of a Cleanup and Abatement Order, a regional board may require replacement water be provided. To issue a Cleanup and Abatement Order, the Central Coast Water Board will need to provide substantial evidence that the grower in question was causing the condition of pollution or nuisance. It is not an authority that the Central Coast Water Board may use without appropriate due process. Nor is it appropriate to reference the Central Coast Water Board's enforcement authority here because it implies that it is a substantive provision of the Preliminary Draft Order itself.

F. Aquatic Habitat Protection Requirements – Part G

The aquatic habitat provisions in Part G are unlawful and impractical for many reasons. Among other things, the provisions result in an unconstitutional taking of private property, unlawfully dictate the manner of compliance, supersede the authority of the Department of Fish and Game, prevent waterway maintenance activities for flood control, prohibit growers from complying with buyer specifications that may be necessary for food safety reasons, and unlawfully require federal permits under the CWA for activities that are specifically exempt.

1. The Aquatic Habitat Restrictions Are an Unconstitutional Taking of Private Property

The Preliminary Draft Order proposes minimum riparian buffer widths of 50 feet, 75 feet, and 100 feet for tier 1, 2, and 3 streams, respectively. The Preliminary Draft Order argues that the buffers are necessary to protect aquatic habitat. Additionally, the Preliminary Draft Order would mandate that growers maintain vegetation in the buffer zones, and would prohibit the removal of vegetation for food safety reasons. Individually and collectively, the aquatic habitat requirements are governmental regulations that deprive agricultural landowners near streams of the economic benefit of their private property. Deprivation in this manner constitutes a taking under the State and Federal Constitutions. (See *Penn Central Transp. Co. v. City of New York* (1978) 438 U.S. 104; see also *Allegretti & Co. v. County of Imperial* (2006) 138 Cal.App.4th 1261.) Pursuant to current regulatory takings jurisprudence, in making this determination courts examine the economic impact on the land in question, the investment-backed expectations of the landowner, and the character of the government action. For the reasons below, the Central Coast Water Board's aquatic habitat provisions would meet the balancing test set forth by the courts, and would be considered a taking of private property.

First, to address economic impact, it must be determined if the regulation unreasonably impairs the value or use of the property in light of the owner's general use of that property. The economic impact of the aquatic habitat regulations on growers in the Central Coast is potentially significant. Productive farmland will be forced out of production and produce buyers may not purchase product from growers where there is significant vegetation near the edge of the field. Thus, not only will growers lose valuable farmland in the buffer area, but the crop as a whole may be unmarketable because of the vegetation that would be required in the buffer area. Second, the general use of land affected by the proposed regulation is most likely designated for and dedicated to the production of agriculture. This general use would be completely eliminated by the regulatory requirements mandating the maintenance of a riparian buffer zone, thereby causing an unquestionably severe economic impact on the landowner. Next, the regulations proposed by the Central Coast Water Board would almost certainly interfere with the investment-backed expectations of the landowners. Agricultural land is purchased with the expectation that it is productive ground—suitable for the crops grown by the grower. With the purchase of agricultural land, growers also invest in machinery and a labor force necessary to grow and harvest the commodity in question. By depriving landowners of all economically beneficial use of the land by designating a riparian buffer zone and requiring maintenance of vegetation regardless of food safety concerns, the proposed regulation will severely interfere with the investment-backed expectations of the landowners. Finally, while the proposed regulation may not constitute a typical physical invasion or appropriation of the land, the proposed regulation would effectively appropriate these riparian buffer zones to the Central Coast Water Board for their perceived public benefit. Even if no such appropriation is found, the severity of the economic impact and the devastation of the investment-backed expectations of the landowners are sufficient to demonstrate a regulatory taking.

2. The Aquatic Habitat Regulations Unlawfully Dictate the Manner of Compliance

As discussed previously (section II.D.2, *ante*), the Central Coast Water Board is prohibited from prescribing the manner of compliance. (Wat. Code, § 13360.) A regional board may adopt waiver conditions that identify what must be done (i.e., protect aquatic habitat); however, a regional board cannot prescribe how it should be done. In the Preliminary Draft Order, the Central Coast Water Board proposes to dictate that buffers of certain sizes must be maintained, vegetation must be maintained, clearing of beneficial vegetation is prohibited, clear cutting or creating bare dirt is prohibited, and channel clearing is prohibited. All of these requirements clearly dictate how to comply with the general requirement to protect aquatic habitat. Furthermore, the requirement for clear cutting or creating bare dirt would apply to all areas of the agricultural operation and not just the riparian buffer areas. In other words, growers would be prohibited from removing vegetation and debris prior to preparing ground for the next planting.

3. The Central Coast Water Board Is Attempting to Supersede the Department of Fish and Game's Requirements for Streambed Alteration Requirements

In Part G, the Central Coast Water Board is attempting to take control of decisions that are rightfully administered by the California Department of Fish and Game (DFG). Department of Fish and Game Code section 1600 et seq. provide the DFG with the authority for reviewing and approving any proposed activity that may substantially, "divert or obstruct the natural flow of, or substantially change or use any material from the bed, channel or bank of, any river, stream, or lake . . . ." (Fish & G. Code, § 1602.) Without the DFG's approval, the activity is prohibited. (*Id.*) Here, the Central Coast Water Board is attempting to interfere with the DFG's authority by prohibiting any such activities altogether. We contend that the Central Coast Water Board has neither the authority nor the expertise to prohibit activities in the stream.

First, relevant portions of the Fish and Game Code may only be administered and enforced through the DFG. (Fish & G. Code, § 702.) Second, staff at the DFG have the expertise to determine what activities in streams may be detrimental to aquatic life—not Central Coast Water Board staff. Instead of adopting blanket prohibitions, the Central Coast Water Board should merely reference the need to comply with Fish and Game Code section 1600 et seq., as administered by the DFG.

4. The Central Coast Water Board Is Attempting to Expand Application of CWA Requirements

Provision 80 of the Preliminary Draft Order implies that an agricultural discharge to a water of the United States is subject to CWA permitting requirements. (Attachment B at p. 70.) If that is so, the Central Coast Water Board is ignoring the provisions in the CWA that specifically exempt agricultural discharges from the NPDES permitting requirements of the CWA. Further, the primary purpose of the Preliminary Draft Order is to provide growers with the ability to comply with Porter-Cologne. As worded in provision 80, the Preliminary Draft Order would not provide the regulatory mechanism for discharges to surface waters that are considered waters of the United States.

II. Preliminary Draft Order Inappropriately Proposes Application of Water Quality Objectives to Irrigation Runoff and Unlawfully Creates Unadopted Water Quality Objectives

Buried in the preface to Tables 1A and 1B in Attachment A is the statement that "water quality objectives indicated by a double asterisk (**) must be met in irrigation runoff per the compliance time schedule contained in the Preliminary Draft Agricultural Order, Part H and are included as individual discharge monitoring requirements." (Attachment A at p. 40.) Water quality objectives identified with the double asterisk include toxicity, ammonia, nitrate, pH, temperature, total dissolved solids, and turbidity. By requiring irrigation runoff to meet water quality objectives, the Central Coast Water Board is in effect adopting end-of-pipe effluent limitations for all irrigation runoff. Additionally, Tables 1A and 1B include numeric values as "Indicators of Narrative Objective" that are de facto water quality objectives.

Water quality objectives are defined to mean, "the limits or levels of water quality constituents or characteristics which are established for the *reasonable* protection of beneficial uses of water . . . ." (Wat. Code, § 13050(h), emphasis added.) Porter-Cologne requires each regional board to establish water quality objectives in Basin Plans, and to adopt the Basin Plans through a public hearing process. (Wat. Code, §§ 13241, 13244.) More importantly, when adopting water quality objectives, regional boards must comply with Water Code section 13241, which requires consideration of a number of factors, including economics and the feasibility of the meeting the objective. (See Wat. Code, §§ 13241(c), (d).) Table 1A identifies many "Indicators of Narrative Objectives." For example, the Biostimulatory Substances objective includes an indicator of 1 mg/L of nitrate to protect aquatic life beneficial uses from biostimulation. (Attachment A at p. 43.) The source for this indicator is a technical paper prepared by the Central Coast Water Board staff. The indicator of 1 mg/L for nitrate has never been proposed or adopted as a water quality objective. Thus, it has not been found to be necessary to *reasonably* protect the aquatic life beneficial use. Without going through the formal adoption process, it is impossible to know the economic impacts associated with meeting this objective, and if it could reasonably be achieved. The Central Coast Water Board cannot ignore its legal responsibility to adopt water quality objectives pursuant to Porter-Cologne by claiming that they are "Indicators of Narrative Objectives." Unless the Central Coast Water Board adopts the pseudo water quality objectives pursuant to the law, the "indicator" values identified are unlawful and must be removed from Tables 1A and 1B.

Next, water quality objectives are adopted to protect the beneficial uses of the *receiving water*. In other words, water quality objectives apply to the receiving waters of the state and not irrigation runoff at the end of the field. It is inappropriate for the Central Coast Water Board to adopt blanket end-of-field effluent limitations for constituents by claiming that the objectives must be met in irrigation runoff. Effluent limitations are typically ordered by a regional board through the adoption of waste discharge requirements under Water Code section 13263. When adopting waste discharge requirements, a regional board is required to consider a number of factors, including the provisions of Water Code section 13241 (e.g., economics). (Wat. Code, § 13263(a).) A blanket effluent limitation as proposed for adoption here ignores the requirements of Water Code section 13263. Further, the adoption of effluent limitations is not consistent with adoption of a waiver from waste discharge requirements, and the Central Coast Water Board's adoption of a waiver cannot be used to circumvent requirements in Porter-Cologne that would otherwise apply.

As a practical matter, some of the constituents identified with a double asterisk cannot be applied directly to irrigation runoff. For example, the water quality objectives for pH and turbidity specifically refer to ambient, or receiving water conditions. Thus, it is impossible to apply these objectives directly to irrigation runoff. Attachment A and Tables 1A and 1B must be revised to indicate that the water quality objectives identified apply only to waters of the state, and not at the end of the field or in agricultural drainage facilities. Further, only actual water quality objectives adopted legally into the Basin Plan should be included in the tables. All others must be deleted, as they are unlawfully adopted water quality objectives.

III. The Burden of Preparing and Complying With the Monitoring and Reporting Requirements Fails to Bear a Reasonable Relationship to the Need, and Therefore are Unlawful

The Preliminary Draft Report describes the monitoring and reporting requirements anticipated for growers subject to the Preliminary Draft Order, including as follows: (1) Individual Discharge Characterization Monitoring; (2) Individual Discharge Monitoring; (3) Watershed Monitoring; and (4) Additional Monitoring Required by the Executive Officer. (See Preliminary Draft Report at pp. 19-25.) Although the details of the proposed monitoring programs have yet to be released, the descriptions provided indicate that the burden of preparing the individual discharge characterization and conducting individual discharge monitoring will not bear a reasonable relationship between the Central Coast Water Board's need for the information as compared to the benefits to be obtained. (See Wat. Code, § 13267(b)(1).) In particular, as part of the characterization report, individual growers will be required to monitor, among other things, flow, toxicity, total nitrogen, nitrate, and ammonia in both surface and groundwater discharge. The brief description provided does not explain how or where a grower is to measure "discharge to groundwater." Further, the brief description does not indicate the frequency of monitoring that will be required as part of the characterization report. Based on the information obtained from the individual characterization report, we can anticipate that individuals will then be required to continue to monitor for these and perhaps other constituents on an ongoing basis. Individual growers will also be required to participate in watershed monitoring efforts for both surface water and groundwater. The collective costs for monitoring on an individual basis and participating in watershed monitoring efforts are likely to be extensive. In exchange, the Central Coast Water Board obtains reams of information that would not directly relay data results regarding water quality in waters of the state. For example, monitoring irrigation runoff is not useful for it fails to account for dilution and degradation of constituents that may occur prior to entering or impacting a water of the state. Considering the costs associated with individual monitoring, and the Central Coast Water Board's inability to determine water quality impacts to waters of the state from concentration levels in irrigation runoff, the burden does not bear a reasonable relationship to the benefits.

In light of the significant legal and practical failings in the Preliminary Draft Order, Central Coast Water Board staff have no alternative other than to rescind the Preliminary Draft Order in its entirety. Once rescinded, Central Coast Water Board staff can then turn their attention to working with the Central Coast agricultural community to draft a reasonable program as set forth in the agricultural alternative that GSA, Farm Bureaus, and others support.

Sincerely,

Theresa A. Dunham

Theresa A. Dunham

cc: Jeffrey S. Young, Chair, CCRWQCB (via U.S. mail only)
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March 25, 2010

Central Coast Regional Water Quality Control Board
Ms. Angela Schroeter
895 Aerovista Place, Suite 101
San Luis Obispo, CA 93401-7906

Dear Ms. Schroeter,

My name is Dennis Caprara, President and owner of R.C. Farms and R.C. Packing. We farm 10,700 acres of vegetable crops in the Salinas Valley, San Joaquin Valley and Yuma, Arizona. We employ about 1200 people in our operations. We have been operating for the last 5 and one-half years under the current Ag Waiver. We have and are implementing management practices to be in compliance with that waiver. Now, it appears the Regional Water Quality Control Board wishes to impose restrictions in the new waiver that would severely damage our business economically and put a lot of people out of work.

The proposed new Ag Waiver has some of the components of the old waiver, which we can live with. However, I'll list a few of the proposals which are unreasonable and, more importantly, unattainable.

1. Establishment of riparian areas. This would make some of our property impossible to farm.

2. Elimination of tile systems or treatment of tile water. No science has been developed to treat this water.

3. The farm plan requires a nutrient management element be prepared and approved by a certified crop advisor. CPA's have no experience to make nutrient needs calls.

4. The farm plan requires that farmers map and photo document existing perennial, intermittent or ephemeral streams or riparian or wetland area habitat and implement mandatory buffers of 50, 75 & 100 feet from the stream bank for riparian habitat within 4 years of adoption. As an alternative to habitat buffers, farmers can prepare a Riparian Function Protection Restoration Plan, certified by a registered engineer or geologist, that restores aquatic life and wildlife support. This becomes a land use issue and the MRWQCB has no jurisdiction.

5. The Waiver prohibits channel clearing, except for ag ditches, hydro-modification and the clearing of beneficial vegetation for food safety reasons. This leaves no provision for flood control.

6. Leaching to control salt must not be performed to wash nitrate based salts from the soil profile. How do you perform leaching if you shut off the tile drains?

7. Within 2 years from adoption, farmers must eliminate all irrigation runoff or provide water quality data through individual on the farm monitoring that irrigation runoff has been sufficiently treated or controlled to meet water quality toxicity standards for pesticides. (Chlorpyrifos 0.025 ug/L; Diazinon 0.14 ug/L). For coarse soils with slope, this time period is unreasonable.

8. Within 3 years from adoption, farmers must eliminate all irrigation from their farming operation or in the alternative, provide data to show runoff has been treated or controlled to meet sediment and turbidity standards. (Turbidity 5 NTO when less than 25 NTU in receiving water; 20% when 25 to 50 NTU; 10 NTU when 30 to 100 NTU; 10% when greater than 100 NTU). This would put a lot of people out of work. Three years is unattainable.

9. Within 6 years from adoption nitrate and salt discharges to groundwater must meet water quality standards. Farm production wells are now above 1 mg/L in most cases. There is no way you could reduce any discharges to this standard.

10. For farms that cannot eliminate tail water, they will have to conduct individual on farm reported monitoring. A quality assurance plan (QAP) must be submitted within 3 months of order adoption, start implementing monitoring within 6 months and start submitting reports to RWQCB 3 months later. A third party entity can conduct this monitoring, but all data must be reported to RWQCB. The Executive Office may postpone individual monitoring where discharges within a watershed collectively are making progress toward meeting the timelines of compliance. The timeline for this requirement is unreasonable.

These are a few of the issues for us in our operation. There could be more.

In summary, I believe there is a fatal flaw in the Ag Waiver in that the beneficial uses for some of the 303d listed surface waters are wrong and need to be challenged legally or changed legislatively. Why would you require drinking water standards for a watershed, where it is not used for drinking water? Why require standards for fish where there is no fishing? Why would you require the water meet standards for recreation where that is and never has been the use?

The RWQCB is requiring Agriculture to meet standards for constituents which are unattainable and there has been no science developed to correct the problem.

In these economic times and with unemployment what it is, someone needs to start applying some common sense.

Sincerely,

Dennis Caprara
RC Farms and RC Packing

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April 1, 2010

Jeffrey S. Young, Chairman of the Board
Roger Briggs, Executive Officer
California Regional Water Quality Control Board
Central Coast Region
895 Aerovista Place, Suite 101
San Luis Obispo, California 93401

Re: ***Comments in Response to Preliminary Staff Recommendations for an Agricultural Order to Control Discharges from Irrigated Lands***

The California Farm Bureau Federation is a non-governmental, non-profit, voluntary membership California corporation whose purpose is to protect and promote agricultural interests throughout the state of California and to find solutions to the problems of the farm, the farm home and the rural community. Farm Bureau is California's largest farm organization, comprised of 53 county Farm Bureaus currently representing approximately 81,000 members in 56 counties. Farm Bureau strives to protect and improve the ability of farmers and ranchers engaged in production agriculture to provide a reliable supply of food and fiber through responsible stewardship of California's resources.

On behalf of the Santa Barbara County Farm Bureau, the San Luis Obispo County Farm Bureau, the Monterey County Farm Bureau, the San Benito County Farm Bureau, the Santa Cruz County Farm Bureau, the Santa Clara County Farm Bureau, and the San Mateo County Farm Bureau, the California Farm Bureau Federation ("Farm Bureau") respectfully presents the following concerns regarding the Preliminary Staff Recommendations for an Agricultural Order to Control Discharges from Irrigated Lands and accompanying Staff Report (hereinafter "Staff Draft Waiver") released on February 1, 2010. Farm Bureau has many concerns with Staff's Draft Waiver and Staff Report.[1]

[1] The Preliminary Draft Waiver and Staff Report consist of many different parts, all of which are objectionable. The actual "waiver" is set forth in the Preliminary Draft Agricultural Order No. R3-2010-00XX and consists of 25 pages and 141 findings. The inaccuracy and unlawfulness of the findings are too many to identify here. Farm Bureau reserves the right to provide additional comments and concerns in the future.

Agriculture is one of the most important industries in the Central Coast Region because of the ability to produce large quantities of readily available food and fiber, the substantial economic benefits it provides to the Region and the State, and the number of workers it employs which leads to significant positive impacts to both the Region's and State's labor force. Farm Bureau members of the Central Coast agricultural community recognizes agriculture's importance and necessary role in the State and Region. Additionally, they recognize that the quality of agricultural water discharges can and will improve through implementation of on-farm practices.

The true goal of the Conditional Ag Waiver is to improve water quality over time. The State Water Code and the Regional Board Basin Plan provide authority for the Regional Board to impose regulations on dischargers to improve water quality. Farmers are equally concerned about water quality and the environment. However, there is no need for the Regional Board to impose arbitrary restrictions on commercial agriculture so long as farmers take necessary steps to demonstrate water quality improvement over a scientifically feasible timeline with intermediate milestones.[2] In order to reach this goal, the primary focus of maintaining and improving water quality over time should remain. To aid in reaching this goal, the Regional Board should evaluate water quality data collected and use such data to implement and adjust management practice implementation. The process of designing and adopting a new Ag discharge program will not be simple or quick. Further collaboration between the Regional Board and agriculture will be necessary to develop a workable long term solution. The Farm Bureaus hope the Regional Board will proceed with the development of a long term program rather than conditional waivers limited to five year terms.

Staff's Draft Waiver contains stringent new conditions that will subject growers in the Region to the most rigorous regulatory program in the state. The Waiver contains duplicative regulations concerning existing perennial, intermittent, and ephemeral streams along with riparian and wetland area habitat. It includes strict controls for the use of pesticides which is already regulated by the Department of Pesticide Regulation and the California Department of Food and Agriculture. Riparian and wetland area habitat is already being regulated by a variety of different regulatory agencies including, but not limited to, the U. S. Fish and Wildlife Service, the Department of Fish and Game, the Army Corp of Engineers, and local land use regulations already in place. The Draft Waiver also contains numerous provisions that are improper, illegal, and exceed the Regional Board's statutory authority. Additionally, Farm Bureau is concerned that the Regional Board may fail to recognize that agricultural lands are a part of the physical environment, thus consideration of impacts to agricultural resources must be included as part of a proper California Environmental Quality Act ("CEQA") environmental review.

Failure to Comply with CEQA Requirements

The Regional Board has failed to comply with the provisions of the California Environmental Quality Act ("CEQA"), Cal. Pub. Resources Code §§ 21000 et seq. CEQA was enacted to address concerns about environmental quality in the State of California. CEQA establishes processes and procedures to ensure that California agencies complete an environmental analysis

[2] The agricultural community has been taking necessary steps to demonstrate water quality improvements.

and consider and disclose to the public the environmental impacts of a proposed project. (Cal. Resources Code, §§ 21000 et seq; Cal. Code Regs., tit. 14, § 15000 et seq.) CEQA's statutory framework sets forth a series of analytical steps intended to promote the fundamental goals and purposes of environmental review—information, public participation, mitigation, and governmental agency accountability. (Cal. Code Regs., tit. 14, § 15002.) Specifically, the Legislature's intent in enacting CEQA includes:

- Disclose potential environmental impacts of agency decisions to decision-makers and the public;
- Analyze and minimize environmental effects of projects before final approval;
- Foster public involvement in governmental decision making;
- Facilitate interagency coordination;
- Identify and mitigate significant effects; and
- Improve decision-making.

(See Pub. Resources Code, §§ 21001, 21001.1, 21002, 21003, 21006, 21064.) CEQA's intent and purpose foster informed public participation and decision-making. (*Laurel Heights Improvement Assn. v. Regents of University of California* (1988) 47 Cal. 3d 376, 404.)

To date, the process and the development of the Staff's Draft Waiver has not been an open, collaborative, or transparent process. The lack of detail, supporting evidence, proper environmental analysis, and proper evaluation of alternatives effectively bars the public from providing meaningful and necessary information on the development of future agricultural discharge programs. Such action and inaction has not satisfied the intent of CEQA.

Agricultural Resources Must Be Considered During Environmental Review

Agricultural resources are an important feature of the existing environment of the State, and are protected under federal policies, such as the Farmland Protection Policy Act and National Environmental Policy Act ("NEPA"), State policies, and CEQA. Agriculture is the number one industry in California, which is the leading agricultural state in the nation. (Food & Agr. Code, § 802(a).) Agriculture is one of the foundations of this State's prosperity, providing employment for one in 10 Californians and a variety and quantity of food products that both feed the nation and provide a significant source of exports. (CALFED Final Programmatic EIS/EIR, July 2000, pg. 7.1-1.) In 1889, the State's 14,000 farmers irrigated approximately one million acres of farmland between Stockton and Bakersfield. By 1981, the number of acres in agricultural production had risen to 9.7 million. (Littleworth & Garner, California Water II (Solano Press Books 2007) p. 8.) More recently, the amount of agricultural land in the State has declined. From 1982 to 1992, more than a million acres of farmland were lost to other uses. Between 1994 and 1996, another 65,827 acres of irrigated farmland were lost, and this trend is expected to continue.

In order to preserve agriculture and ensure a healthy farming industry, the Legislature has declared that "a sound natural resource base of soils, water, and air" must be sustained, conserved, and maintained. (Food & Agr. Code, § 802(g).) Prior to negatively impacting agricultural lands, decision makers must consider the impacts to the agricultural industry, the

State as a whole, and "the residents of this state, each of whom is directly and indirectly affected by California agriculture." (Food & Agr. Code, § 803.)

CEQA require analysis of significant environmental impacts and irreversible changes resulting from proposed projects. These include unavoidable impacts; direct, indirect, and cumulative effects; irreversible and irretrievable commitment of resources; relationships between short-term uses and long-term productivity; and growth-inducing impacts to the environment. Pursuant to CEQA, the physical environment includes agricultural lands and resources. Given the national and statewide importance of agriculture and the legal requirements of environmental review, Farm Bureau urges the Regional Board to properly assess all direct and indirect effects on the agricultural environment resulting from the proposed Staff Draft Waiver.

Agricultural Resources Must be Considered In a Legally Defensible CEQA Review

One of the major principles of the State's environmental and agricultural policy is to sustain the long-term productivity of the State's agriculture by conserving and protecting the soil, water, and air that are agriculture's basis resources. (Food & Agr. Code, § 821(c).) As currently proposed, Staff's Draft Waiver goes beyond its intent to maintain and improve the quality of waters of the state, and instead, imposes a highly burdensome, enforcement driven program, many aspects of which are beyond the Regional Board's authority, that will negatively impact the ability to produce food and fiber and will lead to possible changes in the physical environment. It is foreseeable that such impacts have the potential to convert agricultural lands to other uses. This conversion would add to the existing statewide conversion of substantial amounts of agricultural lands to other uses, and may conflict with adopted plans of many local governments, including cities and counties, and existing habitat conservation plans or natural community conservation plans.

Of particular relevance is CEQA Guidelines Appendix G, section II, Agricultural Resources, which states the following:

> In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agriculture Land Valuation and Site Assessment Model (1997) prepared by the California Department of Conservation as an optimal model to use in assessing impacts on agriculture and farmland. Would the project:
>
> (a) Convert prime farmland, unique farmland, or farmland of statewide importance . . . to non-agricultural use?
> (b) Conflict with existing zoning for agricultural use or a Williamson Act contract?
> (c) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of farmland to non-agricultural use?

(Cal. Code Regs., tit. 14, Appendix G, section II, Agricultural Resources.) Any and all adverse environmental effects on agricultural resources resulting from the project, as well as cumulative impacts that will occur over time, must be fully assessed and disclosed under CEQA, as well as avoided or mitigated as required by CEQA. Thus, proper environmental analysis of agricultural impacts must be considered.

The Regional Board Failed to Analyze Probable Physical Changes to the Environment

CEQA requires lead agencies to analyze the potential physical changes in the environment. For a waiver of waste discharges from irrigated lands, the analysis should consider numerous areas, including the physical impacts that would likely occur as a result of monitoring activities, the implementation of management practices to maintain the quality of waters or mitigate the impacts of agricultural wastes on the waters of the State, social and economic effects stemming from physical changes in the environment.[3]

CEQA requires agencies to consider a reasonable range of foreseeable methods of compliance. For each method, the agency must consider impacts, mitigation, alternatives, costs, and technical factors. (Pub. Resources Code, § 21100; Cal. Code Regs., tit. 14, §§ 15064, 15126.6.) Staff's Draft Waiver must consider the reasonably foreseeable consequences of adoption of the draft policy. Staff's Draft Waiver and accompanying "environmental analysis" fails to contain: an analysis of the reasonably foreseeable methods of compliance, the reasonably foreseeable environmental impacts of the methods of compliance, an analysis of reasonably foreseeable feasible mitigation measures, and an analysis of reasonably foreseeable alternative means of compliance within the rule or regulation.

A full description of monitoring activities proposed under Staff's Draft Waiver is not provided. Thus, it is premature for Staff to conclude that such activities will not have a physical change on the environment, and/or a possible significant effect. (See Attachment 5.) Additionally, some management practices may require physical changes to the environment. For example, a physical change in the environment may occur if structural controls to reduce the discharges of waste to waters of the State are implemented. Even with the lack of details, reasonably foreseeable means of compliance may have an adverse impact on the environment. Thus, by failing to consider any of the above, the Regional Board fails to comply with CEQA.

Regional Board's Consideration of Project Alternatives Is Not Adequate

The Regional Board must consider all reasonable alternatives to the project. (*Laurel Heights Improvement Assn. v. Regents of University of California* (1988) 47 Cal. 3d 376, 400; ["The foregoing CEQA provisions and Guidelines make clear that 'One of its [an EIR's] major functions . . . is to ensure that all reasonable alternatives to proposed projects are thoroughly assessed by the responsible official.' (*Wildlife Alive v. Chickering* (1976) 18 Cal.3d 190, 197 [132 Cal.Rptr. 377, 553 P.2d 537].)"] The Guidelines require the evaluation of a "'reasonable range of alternatives to the project, or to the location of the project, which could feasibly attain the basic objectives of the project and evaluate the comparative merits of the alternatives." (Guidelines, § 15126, subd. (d).) These alternatives must be discussed, 'even if these alternatives would impede to some degree the attainment of the project objectives, or would be

[3] Discussed infra.

more costly.' (Guidelines, § 15126, subd. (d)(3).)" "'Feasible' means capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors." (Cal. Code Regs., tit. 14, § 15364; *Laurel Heights Improvement Assn. v. Regents of University of California* (1988) 47 Cal. 3d 376, 402.) Alternatives to be evaluated must be potentially feasible and should feasibly attain most of the basic objectives of the project. (Cal. Code Regs., tit. 14, § 15126.6.)

Given CEQA's requirements, the Regional Board should consider feasible alternatives, especially those alternatives to be submitted by the public and the agricultural community. However, within the Preliminary Draft Report, one page of text is devoted to a brief and vague outline of possible alternatives of the project. (Attachment 5, pp. 7-8.) Three "alternatives" are inadequately described in a conclusory nature in which all three "alternatives" are not recommended. Such "brief" treatment of so called alternatives is legally deficient, as no project alternatives are fully analyzed, described, evaluated, or provided in detail to allow the public to provide meaningfully comments. (*Laurel Heights Improvement Assn. v. Regents of University of California* (1988) 47 Cal. 3d 376, 404; ["The key issue is whether the selection and discussion of alternatives fosters informed decisionmaking and informed public participation."]; Cal. Code. Regs., tit. 14, § 15126(d)(5).) This failure to properly consider project alternatives cannot be upheld under CEQA and the "rule of reason" for considering alternative project components and regulatory requirements.

<u>Reliance on the 2004 Negative Declaration is Unreasonable and Invalid</u>

Staff's Draft Waiver is significantly different and drastically distinct from the 2004 Conditional Waiver. As stated in the Preliminary Draft Report, specific changes in Staff's Draft Waiver include:

- Extends effective term of the conditional waiver to 2015.
- Revises enrollment and termination process (new information required).
- Requires submittal, certification, and revision (if needed) of Farm Plans.
- Expands contents of Farm Plan, including management practices to eliminate or reduce pollution loading and discharges.
- Adds management practices implementation schedule.
- Requires riparian buffer (or alternative aquatic habitat protection) setback in certain circumstances.
- Prohibits disturbance of wetlands and streams.
- Removes education as a requirement.
- Adds monitoring to facilitate compliance evaluation.
- Adds definitions, references, and expanded findings to clarify and support the requirements specified in the Preliminary Draft Irrigated Ag Order.

(Attachment 5, pp. 2-3.) In addition to the above revisions and addition, Staff's Draft Waiver deviates significantly from the 2004 Conditional Waiver. Although both waivers are conditional waivers of waste discharge limited to 5 year periods of time and regulate discharges from irrigated lands, the two waivers are extremely different in scope, regulatory focus, requirements, breadth, enforcement, intent, types and contents of monitoring, types of discharges to be regulated, reporting requirements, as well as other differences. Thus, reliance on the 2004 Negative Declaration to fully determine and analyze the new environmental impacts of Staff's 2010 Draft Waiver is inappropriate and improper.

In addition to significantly altering the scope of the waiver, significant new information has been gathered and is now available since the completion of the 2004 Conditional Waiver. Given this significant information and substantial changes to the current Conditional Waiver, which should constitute a new project under CEQA, Staff cannot rely upon the environmental analysis that was completed in 2004. Notwithstanding the fact that reliance on a previous project that is distinct from the project at hand is improper, any changes to the "project" after environmental analysis constitute "significant new information" that requires additional environmental analysis.[4]

The Initial Study and Environmental Checklist is Inadequate and Conclusory In Nature

Under CEQA, it is the responsibility of the lead agency to determine whether an EIR shall be required. (Cal. Code Regs., tit. 14, § 15365.) The initial study is the preliminary analysis that the lead agency prepares in order to determine whether the project might have a significant effect on the environment. (*Friends of Davis v. City of Davis* (2000) 83 Cal. App. 4th 1004, 1016, ["the task of the lead agency is not to determine whether the project will have a significant effect on the environment, but only *whether it might have such an effect*." (emphasis added)].) When the agency determines that an EIR is unnecessary, the initial study serves the purpose of "providing documentation of the factual basis" for concluding that a negative declaration will suffice. (Cal. Code Regs., § 15063(c)(5).)

Specifically, the purposes of an initial study are to:

(1) Provide the Lead Agency with information to use as the basis for deciding whether to prepare an EIR or a Negative Declaration.
(2) Enable an applicant or Lead Agency to modify a project, mitigating adverse impacts before an EIR is prepared, thereby enabling the project to qualify for a Negative Declaration.
(3) Assist in the preparation of an EIR, if one is required, by:
    (A) Focusing the EIR on the effects determined to be significant,
    (B) Identifying the effects determined not to be significant,
    (C) Explaining the reasons for determining that potentially significant effects would not be significant, and

[4] CEQA Guidelines section 15088.5(a) states that "significant new information" includes:
(1) A new significant environmental impact would result from the project or from a new mitigation measure proposed to be implemented.
(2) A substantial increase in the severity of an environmental impact would result unless mitigation measures are adopted that reduce the impact to a level of insignificance.
(3) A feasible project alternative or mitigation measure considerably different from others previously analyzed would clearly lessen the environmental impacts of the project, but the project's proponents decline to adopt it.
(4) The draft EIR was so fundamentally and basically inadequate and conclusory in nature that meaningful public review and comment were precluded.

(D) Identifying whether a program EIR, tiering, or another appropriate process can be used for analysis of the project's environmental effects.

(4) Facilitate environmental assessment early in the design of a project;
(5) Provide documentation of the factual basis for the finding in a Negative Declaration that a project will not have a significant effect on the environment;
(6) Eliminate unnecessary EIRs;
(7) Determine whether a previously prepared EIR could be used with the project.

(Cal. Code Regs., tit. 14, § 15063(c).)

The initial study serves to document the agency's reasoning in reaching its conclusion to prepare an environmental impact review document or a negative declaration. Here, Staff's Initial Study fails to "disclose the data or evidence upon which the person(s) concluding the study relied. Mere conclusions simply provide no vehicle for judicial view." (*Citizens Assn. for Sensible Development of Bishop Area v. County of Inyo* (1985) 172 Cal. App. 3d 151, 171.) By failing to disclose all data and evidence relied upon, the Regional Board is abusing its discretion and failing to comply with CEQA. (*Citizens Assn. for Sensible Development of Bishop Area v. County of Inyo* (1985) 172 Cal.App.3d 151, 171, ["Section 1094.5, subdivision (b), states that '[abuse] of discretion is established if the respondent has not proceeded in the manner required by law, the order or decision is not supported by the findings, or the findings are not supported by the evidence.' The Supreme Court has elaborated that '. . . implicit in section 1094.5 is a requirement that the agency which renders the challenged decision must set forth findings to bridge the analytic gap between the raw evidence and ultimate decision or order." (*Topanga Assn. for a Scenic Community v. County of Los Angeles, supra*, 11 Cal.3d at p. 515; see *Myers v. Board of Supervisors* (1976) 58 Cal.App.3d 413, 429-431 [129 Cal.Rptr. 902].)"

Conclusory comments in support of environmental conclusions are generally inappropriate. (*Laurel Heights Improvement Assn. v. Regents of University of California* (1988) 47 Cal. 3d 376, 404.) Staff's Initial Study is fundamentally and basically inadequate and conclusory in nature, precluding meaningful public review and comment. *(Mountain Lion Coalition v. Fish and Game Com.* (1989) 214 Cal.App.3d 1043, 1051; *Laurel Heights Improvement Assn. v. Regents of University of California* (1988) 47 Cal.3d 376, 404; Cal. Code Regs., tit. 14, § 15063(c); see Cal. Code Regs., tit. 14, § 15088.5, [regulations apply substantially to initial studies and negative declaration thresholds for recirculation as well.].)

In the Initial Study, the Regional Board merely concludes that the Draft Waiver will not cause any effects "more severe than discussed in the 2004 Environmental Analysis/Negative Declaration" and, therefore, will protect waters of the State. (Attachment 5, p. 1.) The Regional Board provides no citation or evidence for such conclusions. This sort of conclusory statement provides "no basis for a comparison of the problems involved with the proposed project and the difficulties involved in the alternatives." (*People v. County of Kern* (1974) 39 Cal.App.3d 830, 841-842, quoting Silva v. Lynn (1973) 482 F.2d 1282, 128; see also *Laurel Heights Improvement Assn. v. Regents of University of California* (1988) 47 Cal.3d 376, 404, ["but neither can we countenance a result that would require blind trust by the public, especially in light of *CEQA's fundamental goal that the public be fully informed* as to the environmental consequences of action by their public officials" (emphasis added)]; *City of Redlands v. County of San*

Bernardino (2002) 96 Cal.App.4th 398, 415, ["The County's conclusory evaluation of the amendments fail to support its decision to adopt a negative declaration."].)

Given that the Regional Board's Initial Study relies on conclusory language, lack of evidence, unidentified and unsubstantiated claims, and unlike comparisons to support its findings that no significant environmental affects will occur, the public's ability to provide input, to collaborate with, and to aid in finding solutions to maintain and/or improve water quality is largely restricted and makes it impossible for the public, many of whom have actively asserted a keen and sophisticated interest in the development of revised/new discharge requirements, to fully participate in the assessment of project impacts and alternatives associated with the project. (See *Mountain Lion Coalition v. Fish & Game Comm.* (1989) 214 Cal. App. 3d 1043, 1051.)

The Initial Study Predisposes the Project's Outcome

As discussed *infra*, the Initial Study and the Staff Report fail to identify and mitigate the Project's significant impacts, fail to provide proper analysis of alternatives, and are improperly predisposed toward Staff's Draft Waiver. (See Attachment 5 Initial Study, pp. 7-8.)

Staff's findings improperly determine that any alternative besides Staff's preferred "Draft Waiver" is infeasible. (Attachment 5, pp. 7-8.) Regional Board Staff must study and evaluate a reasonable range of alternatives and present a fair and unbiased analysis of such alternatives. There are dozens of different ways to formulate methods to maintain and/or improve water quality, if needed, including proper analysis of alternatives yet to presented to the Board. Public alternatives will be submitted to the Board on April 1, 2010, two full months after Staff's conclusory predetermination of the preferred project. Staff should not determine its preferred alternative until after proper analysis of all alternatives.

The Draft Staff Waiver Contains an Inadequate Assessment of Significant Impacts and Effects on the Environment

The CEQA Guidelines define a "significant effect" as: "… a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic and aesthetic significance. An economic or social change by itself shall not be considered a significant effect on the environment. A social or economic change related to a physical change may be considered in determining whether the physical change is significant." (Cal. Code Regs., tit. 14 § 15382; see also Pub. Resources Code, § 21068.)

The CEQA Guidelines further state that, "An ironclad definition of significant effect is not possible because the significance of an activity may vary with the setting. For example, an activity which may not be significant in an urban area may be significant in a rural area." (Cal. Code Regs., tit. 14 § 15064.) Appendix G of the CEQA Guidelines describes impacts that the California Resources Agency has determined are normally considered significant. These guidelines require that physical changes in the environment be evaluated based on factual evidence, reasonable assumptions supported by facts, and expert opinion based on fact. Given that many factors have to be analyzed and significant effects and impacts should be determined on a case-by-case basis, the Regional Board cannot rely on previous antiquated environmental analysis to conclude possible potential impacts to Staff's Draft Waiver. Rather, the Regional Board must review all scientific data and facts, especially information collected since the initiation of the 2004 Conditional Waiver, prior to determining the Staff's Draft Waiver's potential to significantly effect or impact the environment.[5]

The Draft Staff Waiver Fails to Consider Significance of Social and Economic Impacts and Cumulative Effects

Although impacts that are solely economic in nature do not constitute "significant effects on the environment," economic or social impacts that will or have the potential to cause a physical change should be considered. (Cal. Code Regs., tit. 14, §§ 15064(e), 15131.) The term "significant effect on the environment" is defined in Section 21068 of CEQA as meaning "a substantial or potentially substantial adverse change in the environment." (Pub. Resources Code, § 21068.) This focus on physical changes is further reinforced by Sections 21100 and 21151. (Discussion following Cal. Code Regs., tit. 14, § 15131.) Despite the implication of these sections, CEQA does not focus exclusively on physical changes, and it is not exclusively physical in concern. (*Ibid.*) Thus, in certain situations such as the adoption of an expansive regulatory irrigated lands discharge program, economic and social effects of the project must be used to determine the significant effects on the environment. (*Citizens Assn. for Sensible Development of Bishop Area v. County of Inyo* (1985) 172 Cal. App. 3d 151, 170, ["The lead agency shall consider the secondary or indirect environmental consequences of economic and social changes."].) Since such effects were not considered in the Initial Study, the document is incomplete and flawed.

In *Citizens Association for Sensible Development of Bishop Area v. Inyo*, the court held that "economic or social change may be used to determine that a physical change shall be regarded as a significant effect of the environment. Where a physical change is caused by economic or social effects of a project, the physical change may be regarded as a significant effect in the same manner as any other physical change resulting from the project. Alternatively, economic and social effects of a physical change may be used to determine that the physical change is a significant effect on the environment." ((*Citizens Assn. for Sensible Development of Bishop Area v. County of Inyo* (1985) 172 Cal. App. 3d 151, 170.)

Staff's Draft Waiver proposes dramatic and severe impacts on the agricultural industry, which will have a significant effect on the economic and social environment of the Region. Such impacts include negative economic consequences, the possibility of eliminating agricultural crops produced in the area, loss of jobs, loss of food supply, loss of prime agricultural lands,

[5] Water quality regulations that aim to improve environmental quality can have unintended consequences that harm the environment and natural resources. The reallocation of water from one location to another, to meet water quality regulations, may reduce the well-being of fish and wildlife dependent on the water in the source region. Reduction of use of chemical pesticides that reduce farm productivity may lead to an increase in utilized land use and expansion of the utilized land base to wilderness areas. Diversion of water resources to meet environmental quality objectives may reduce the capacity to utilize this water in provision of environmental amenities. Thus, proper environmental analysis is needed.

economic collapse of local communities, changes the landscape and land uses, loss of wildlife habitat, loss of groundwater recharge areas, as well as other social and economic impacts. In addition to direct impacts, indirect impacts and consequences, cumulative[6] consequences are reasonably foreseeable and must be analyzed.

The Draft Staff Waiver Fails to Evaluate Economic Costs

The requirement to consider economics under Porter-Cologne Water Quality Control Act ("Porter-Cologne") is absolute. Water Code, section 13141 explicitly mandates:

> State policy for water quality control adopted or revised in accordance with the provisions of this article, and regional water quality control plans approved or revised in accordance with Section 13245, shall become a part of the California Water Plan effective when such state policy for water quality control, and such regional water quality control plans have been reported to the Legislature at any session thereof.
> However, 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.

(Wat. Code, § 13141.) Before a Regional Board can impose waste discharge requirements or conditioned water quality certification for discharges from irrigated lands, Porter-Cologne requires that it "shall take into consideration" the following factors: "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." (Wat. Code, § 13263.) Section 13241 in turn lists six "factors to be considered," including "economic considerations" and "water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area." (Wat. Code, § 13241.) 13241

Anticipated program implementation costs to the agricultural community include increases in potential fees, management practice implementation, monitoring costs, report preparation, and cost for education, as well as other costs. Given that the impacts of water quality regulations frequently take years to materialize, the Regional Board should analyze the economic costs and impacts within a dynamic framework taking into account the projected changes in the economic situation *over time*.

In addition to direct costs imposed on the agricultural community, the Regional Board should evaluate indirect costs, including the economic consequences that are transmitted via market interactions to other groups, such as consumers. Water quality regulation, such as Staff's Draft Waiver, increases the average cost of production and has a direct negative effect on the producer and the consumer through the resulting increase in variable costs and the output price. The

[6] "Cumulative impacts" are "two or more individual effects which, when considered together, are considerable or….compound to increase other environmental impacts. (Cal. Code Regs., tit. 14, § 15355.)

propagation of the impacts of a regulation through the economy is well documented and can be quantified by economic analysis.

The Scope of Staff's Draft Waiver is Improper

Staff's Draft Waiver seeks to greatly expand the current Conditional Waiver, venturing from a waiver that aims to improve water quality to a waiver that is unlawful, exceeds Regional Board authority, and contains significant and prescriptive requirements that gravely impact growers and agriculture in the Central Coast.

Given the size of the Region and the variety in topography, geography, water conditions, weather conditions, and crops produced, a one size fits all approach is not appropriate. What makes sense basin-wide may not make sense in a particular location, or for a portion of a particular stream. The Regional Board should consider local conditions, both economic and environmental, which can vary widely throughout the Region. In addition, all types of agricultural practices cannot be regulated in the same manner. Staff must account for these differences.

The Staff's Draft Waiver claims that "[t]he agricultural industry must implement the most effective management practices (related to irrigation, nutrient, pesticide and sediment management) that will most likely yield the greatest amount of water quality protection, and verify their effectiveness with on-farm data." (Preliminary Draft Report, p. 7.) This statement runs directly contrary to the legislative intent and purpose of the Porter-Cologne Act. Specifically, Porter-Cologne requires the Regional Board to regulate "to attain the highest water quality which is reasonable, considering all demands being made and to be made on those waters . . . ." (Wat. Code, § 13000.) Thus, any regulation of the agricultural industry must be reasonable considering a number of factors, including cost. Effectiveness alone is not a legal requirement in Porter-Cologne.

Improper Regulation of Nursery Operations

Staff's Draft Waiver expands the current Conditional Waiver to include nurseries, especially commercial nurseries, nursery stock production, and greenhouse operations. Such operations with "soil floors that do not have point-source type discharges, and are not currently operating under individual WDRs," are now regulated. (Attachment 3, p. 5.)

Staff's Draft Waiver contains many undefined and potentially highly impractical requirements for nursery operations. Of particular concern are: (1) Regulation of non-storm water discharge that must have no toxicity, drinking water standards for nitrates, low turbidity, and temperatures below 68°F; (2) Keeping rainwater and/or stormwater separated from wastewater and irrigation runoff; (3) Having to prevent all rainwater from coming into contact with containerized plants. Such requirements are unlawful and infeasible. Prior to mandating industry specific requirements, the Regional Board should gather and utilize nursery specific data and data specific to the Region. This Region is very different from areas throughout the state. Additionally, the geography, climatology, and topography within the Region itself varies substantially. Thus, proper and appropriate data is needed.

Staff's Draft Waiver Exceeds the Regional Board's Statutory Authority and Cannot Regulate Pesticides

California has regulated pesticides for over a century. The California Legislature has established a comprehensive body of law to control every aspect of pesticide sales and use. The California Department of Pesticide Regulation ("DPR") is mandated by law to protect the public health and environment by regulating pesticide sales and use and by fostering reduced-risk pest management. (Food & Agr. Code, §§ 11454, 11454.1, 12981.**)**

This strict oversight begins with product evaluation and registration and continues through statewide licensing of commercial applicators (including Appellant), dealers, and consultants, environmental monitoring, and residue testing of fresh produce. DPR currently has a staff of over 400 employees with an annual budget of approximately $70 million. (*Governor's Budget 2010-11, Proposed Budget Details*, <www.ebudget.ca.gov/stateagencybudgets> [as of March 28, 2010].) This work is augmented by approximately 400 biologists working for County Agricultural Commissioners in all 58 counties on local pesticide enforcement. (California Department of Pesticide Regulation, *A Guide to Pesticide Regulation,* p. 1 http://www.cdpr.ca.gov/doc/pressrls/dprguide/htm> [as of March 28, 2010].)

The California Food and Agriculture Code, division 7, chapter 2 and implementing regulations promulgated at title 3 of the California Code of Regulations, division 6 establish this comprehensive program under which DPR regulates the manufacture, distribution, sale and use of pesticides. The program seeks to provide for the proper, safe, and efficient use of pesticides essential for production of food and fiber, and to protect the public health and safety, as well as the environment, from harmful pesticides by ensuring proper stewardship of those pesticides. (*Californians for Alternatives to Toxics v. California Department of Pesticide Regulation* (2006) 136 Cal. App. 4th 1049, 1057, citing Food & Agr. Code, §11501.)

DPR oversees a multi-tiered enforcement infrastructure. While the Department has primary responsibility for enforcement of pesticide laws, the Pesticide Enforcement Branch and the Pest Management and Licensing Branch work with the County Agricultural Commissioners to enforce regulations at a local level. (California Department of Pesticide Regulation, *A Guide to Pesticide Regulation,* p. 45 <http://www.cdpr.ca.gov/doc/pressrls/dprguide/htm> [as of March 28, 2010].)

Given the need for proper and effective oversight of pesticide use, pesticide regulation is a matter of "statewide concern" that must be regulated from the state level. (Food & Agr. Code, § 11501.5(a).) The Legislature made this unmistakably clear by commencing the section with "this division and Division 7 (commencing with Section 12501) are of statewide concern and occupy the whole field of regulation." (*Ibid.*) The plain meaning of the words within this sentence illustrates the Legislature's intent for state regulation of pesticides and such regulation to be conducted by the Department of Pesticide Regulation and not the Regional Water Quality

Control Boards. Thus, the imposition of pesticide buffers for ground and aerial application is improper and exceeds statutory authority.[7] (See Attachment 3, pp. 63-64.)

Intellectual Property, Trade Secrets, and Proprietary Information Must Remain Confidential

Staff's Draft Waiver expands the nature, scope, contents, and use of the Farm Water Quality Management Plan. Requirements now include additional reporting, including detailed management practices and implementation practices. In addition, upon request, Farm Plans must be sent to the Regional Board. Notwithstanding the issues regarding additional reporting and the management implementation practices report, submittal of proprietary information to the Regional Board is disconcerting. Information within farm plans contains intellectual property, trade secrets, and proprietary information, much of which has no correlation or nexus to the Regional Board's authority to regulate water quality. Prior to any request for the submittal of the entire farm plan, the Regional Board should make a finding showing the necessity of the data and information required to be submitted and how such data is related to water quality. Such information must remain confidential. The Porter-Cologne Act explicitly provides protection to growers for intellectual property, trade secrets, and proprietary information that may be within a farm plan or report:

> When requested by the person furnishing a report, **the portions of a report that might disclose trade secrets or secret processes may not be made available for inspection by the public but shall be made available to governmental agencies for use in making studies**. However, these portions of a report shall be available for use by the state or any state agency in judicial review or enforcement proceedings involving the person furnishing the report.

(Wat. Code, § 13267(b)(2) (emphasis added).) Thus, the Regional Board must acknowledge that farm specific information, including pesticide application, irrigation practices, crop rotations, best management practices, etc., are intellectual property, trade secrets, and proprietary information that must remain confidential.

The Regional Board is Attempting to Circumvent DFG's Longstanding Streambed Alternation Requirements

Many of the activities and impacts sought to be regulated are currently directly or indirectly regulated through local governments, federal, and state agencies. For example, the Department of Fish and Game ("DFG") is responsible for conserving, protecting, and managing California's fish, wildlife, and native plant resources. To meet this responsibility, the Fish and Game Code requires an entity to notify DFG of any proposed activity that may substantially modify a river, stream, or lake. (Fish § Game Code, § 1602.) Persons must notify DFG prior to any activity that will:

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[7] Additionally, the prescription of pesticide buffers, besides not being within the Regional Board's jurisdictional authority, equates to a mandate of a specific management practice. Such mandates are not within the Regional Board's authority.

- Substantially divert or obstruct the natural flow of any river, stream or lake;
- Substantially change or use any material from the bed, channel, or bank of, any river, stream, or lake; or
- Deposit or dispose of debris, waste, or other material containing crumbled, flaked, or ground pavement where it may pass into any river, stream, or lake.

(Fish § Game Code, § 1602.) Given DFG's authority to regulate activities such as channel clearing and other activities, actions included in Staff's Draft Waiver present significant risk of regulatory overlap and duplication and infringe upon the regulatory authority of DFG. Additionally, by including specific provisions within the Draft Waiver that regulate and control streambed alternation, clearing, maintenance, etc, the Regional Board is attempting to circumvent DFG's longstanding streambed alternation requirements. Thus, any expansion of an irrigated discharge waiver to include such activities is duplicative regulation and unnecessary.

The Regulation of Riparian and Wetland Area Habitat Areas Exceeds the Regional Board's Statutory Authority

Regulating land use is not within the purview of the Regional Board. The Water Code and the Basin Plan focus on water quality and activities which may impair water quality. As discussed within, while the Regional Board has authority to prohibit an act which may result in a discharge, the Board does not have authority to require an act which is unrelated to discharges to waters of the state. (Wat. Code, § 13360.) In addition to exceeding its jurisdiction, dictating certain land use practices and prohibitions amounts to a regulatory taking of land by restricting its use without any relationship to water quality. (See *Penn Central Transp. Co. v. City of New York* (1978) 438 U.S. 104; see Attachment 3, pp. 69-72, proposing minimum riparian buffer widths of 50 feet, 75 feet and 100 feet for tier 1, 2, and 3 streams, respectively.)

Notwithstanding the lack of authority, it is also premature to regulate wetlands and riparian habitats. Staff relies upon the State Water Resources Control Board's wetlands definition and "Wetlands and Riparian Area Policy," a policy that is currently still in its infancy and draft stages. (See Attachment 1, p. 26.) Inclusion or exclusion of managed wetlands and riparian areas should depend on the development and final outcome of the State Water Board's Wetlands and Riparian Areas Policy and definition of "wetland." Action prior to the creation of the policy is futile.

Additionally, through its section 1600 Streambed Alteration Program, DFG already regulates upland riparian areas the Regional Board now seeks to regulate. (Fish § Game Code, 1602.) Such duplicative regulation is both inefficient and unnecessary. Thus, any expansion of an irrigated discharge waiver to protect wetland and riparian areas is duplicative regulation and unnecessary.

The Regional Board Does Not Have Authority To Dictate Management Practices and Methods of Compliance

The Regional Board does not have the statutory authority to mandate specific management practices. (Wat. Code, § 13360(a).) The Regional Board has the authority to adopt water quality control plans, water quality objectives to "ensure the reasonable protection of beneficial uses," and waste discharge requirements. (Wat. Code, §§ 13240, 13241, 13242.) However, it cannot dictate the management and business practices undertaken by a landowner to reach the applicable discharge goal. Specifically, the Water Code states:

> No waste discharge requirement or other order of a regional board or the state board or decree of a court issued under this division shall specify the design, location, type of construction, or particular manner in which compliance may be had with that requirement, order, or decree, and the person so ordered shall be permitted to comply with the order in any lawful manner.

(Wat. Code, § 13360(a).) Within the Initial Study, it states that the "Preliminary Draft Irrigated Ag Order does not specify management practices that must be implemented." (Attachment 5, p. 16.) Unfortunately, this statement is incorrect since numerous times within the "Preliminary Draft Order" (Attachment 3), specific types of management practices are mandated.

Under the Preliminary Draft Order, the required Farm Plan would need to identify certain types of management practices including the use of integrated pest management ("IPM"). In fact, the Farm Plan would require a grower to maximize integrated pest management practices. Additionally, the Preliminary Draft Order requires specific management practices to control erosion and sediment, including maintaining crop residue or vegetative cover on the soil. However, the Regional Board has no authority to mandate or require the use of integrated pest management by individual growers or the use of specific types of crop covers.

The Regional Board's Regulation of Groundwater is Improper

As outlined in Staff's Draft Waiver, the Regional Board's proposed manner of groundwater regulation is improper. The Regional Board may not require dischargers to construct and maintain ponds, reservoirs and other containment structures to avoid leaching of waste to groundwater. (See Attachment 3, p. 69.) As discussed previously, prescriptive requirements such as these are considered to dictate the manner of compliance, which is unlawful and improper. (Wat. Code, § 13360.)

In formulating an irrigated lands program, the Regional Board should seek to develop the most efficient program that accomplishes water quality goals. The most efficient and effective methods for achieving these goals do not include the exploratory regulation of groundwater. Water is a critical resource for all of California, especially for agriculture. Without water, irrigated agriculture in the Central Coast will not exist. As a result, a high priority should be placed on efforts to assure that water management and monitoring programs are appropriately tailored to include only the regulation of surface water and equitably distribute regulatory costs across *all* waste dischargers, including those outside the agricultural community.

Groundwater monitoring and regulation is fraught with complexity and is very different than surface water quality monitoring. Monitoring will require a lot of time, expense, and science to identify and solve pollution problems since the ability to obtain good water quality data is difficult due to percolation and groundwater movement. Additionally, detecting pollutants in groundwater and then identifying the source will be a time consuming, exploratory, and difficult endeavor. Before any groundwater monitoring program should be imposed, the Regional Board and State Board should coordinate with other government agencies that are involved in groundwater quality programs, such as the Department of Pesticide Regulation, to avoid duplication and additional expense. Coordination is also needed in order to adequately assess groundwater resources. Using best available science, evaluation of groundwater supplies within the Central Coast must be completed, including mapping of hydrogeologic features; determination of accurate locations and altitudes of wells; accurate estimates of water-budget components; measurements of groundwater levels; collection and analysis of groundwater samples; analysis of numerical models of groundwater flow to evaluate potential effects of changes in land and water use; determination of aquifer storage; stream depletion; well interference; and concrete determination of sources of pollution.

Farm Bureau proposes that the Regional Board defer groundwater management activities to other appropriate agencies and entities that are responsible for the protection of groundwater resources at the local level. Groundwater quality issues are unique to groundwater basins and subbasins. Thus, such issues are best addressed and managed locally.[8] Besides adequate local regulation, the Regional Board should avoid duplicative regulation among a number state agencies working on the same topic. Within the California Department of Pesticide Regulation, there exists the Ground Water Protection Program that regulates the use of certain pesticides found in ground water. (See Cal. Code. Regs., tit. 3, § 6800 et seq.) DPR's program is implemented and enforced by local County Agricultural Commissioners that are familiar with local groundwater conditions.

In light of the local agency efforts to manage groundwater resources, and the DPR regulatory activities that already exist, Farm Bureau recommends that the Regional Board recognize these activities and entities as the appropriate programs for addressing groundwater issues, and therefore determine that it is inappropriate, or at least premature, to adopt a new regulatory program for irrigated agriculture specific to groundwater. Additionally, it is within the Regional Water Board's authority to identify control actions recommended for implementation by others. (Wat. Code, § 13242(a).)[9]

<u>The Aquatic Habitat Protection Requirements are Unlawful</u>

The aquatic habitat provisions within Staff's Draft Waiver are unlawful and impractical for many reasons. The provisions result in an unconstitutional taking of private property, unlawfully dictate the manner of compliance, impede the authority of the Department of Fish and Game, prevent waterway maintenance activities for flood control, prohibit growers from complying

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[8] For example, local management occurs through voluntarily developed groundwater management programs with quality objectives pursuant to Water Code section 10750 et seq.

[9] "Water quality objectives, we realize, may not always be readily enforceable. The statutory factors enumerated in section 13242, particularly the provisions for recommended action and time schedule, reflect the Legislature's recognition that an implementing program may be a lengthy and complex process requiring action by entities over which the Board has little or not control and also requiring significant time intervals." (*United States v. State Water Resources Control Board,* 182 Cal.App.3d 82, 122 (1st District COA, 1986).)

with buyer specifications that may be necessary for food safety reasons, and unlawfully require federal permits under the Clean Water Act for activities that are specifically exempt.

Conclusion

The agricultural community is committed to being stewards of the land and has attempted to work with the Regional Board on this matter since 2003. The agricultural community is fundamentally interested in ensuring the long term improvement of water quality in the region.

Given the diverse array of geography, topography, soil, microclimates, local conditions, and agricultural commodities grown in the Central Coast, water management and monitoring programs must be flexible and allow for necessary adaptations, both for localized areas and throughout the Central Coast. A one-size-fits-all approach to regulating all types of discharges from irrigated lands does not work in this Region due to the diversity of the Region that supports a corresponding variety of plant and animal communities and crop types. As currently drafted, Staff's Draft Waiver contains numerous flaws, areas of concern, exceedances of authority, and infeasible and improper regulations. Farm Bureau urges the Regional Board to revise the Draft Waiver in light of these concerns. Additionally, rather than continuing to amend and negotiate the contents of a conditional agricultural waiver every 5 years, Farm Bureau urges the Regional Board to pursue alternative regulatory vehicle alternatives including a long-term irrigated lands program.

Sincerely,

Kari E. Fisher
Associate Counsel

Implementation of Management Practices
Hearing Testimony excerpts from growers or grower representatives.

March 17, 2011
Page 179 - 180
Danny Merkeley

Growers today -- particularly the better growers -- do pedio samples, do soil samples to know what nitrogen, for example, in this case, needs -- there will be for that particular commodity. In addition to that, we will add soil amendments and things to change the Ph, change the makeup of that soil to increase the -- the ability of -- of that particular commodity to uptake those nutrients. As a farmer, I know that.

Page 246

DR. CAHN: And we monitored for the whole season. I'm giving you numbers that are the average for the whole season. There can be individual irrigation events. You might lose a little water. But the indication here is that the current practices growers are using in strawberries is fairly well in check with what we understand of best management practices.

Page 251

MR. TOMLINSON: And -- and that's what he was -- part of his answer - right? - is that each crop is going to have a different set of practices to try and reduce risk for groundwater because we all need to -- to achieve those goals. But it's all going to look different for each commodity. For here, for strawberries, we have a drip irrigation system that's highly efficient.

Bob Martin Page 230
King City area.

As technology brings us information that we can use to lessen negative impacts on water quality, we listen, we learn and we improvise. The shear size of our operation allows us to experiment and utilize improved methods. If they've proved successful, we're not shy in -- in sharing these results with fellow farmers. I have 15 growers that are raising onions for -- for our company, right now. And I -- I share everything with them. Quick nitrate soil testing has been in our program for close to 15 years now. Backflow prevention devices have been in all of our wells for as long as I can remember. I can't understand why our large operation is singled out in the draft -- staff's proposal, as the highest risk category.

Page 350-351

MR. OVEREEM: Mr. Chairman, members of the board. My name is Eric Overeem, O-V-E-R-E-E-M. I'm a licensed pest control advisor, a certified crop advisor, and I've had the opportunity of

Page 351

working in the Salinas Valley for almost 30 years, now. In my experience, there have been substantial changes to the overall nutrient management, to grow some of the cash crops that we do. Tissue and soil tests; a quick nitress test, prior to sidedress; suction lysimeters to determine what's in the root zone, et cetera, et cetera, I think these have all gone a long ways to improve the nitrogen use efficiency. Also, the adoption of irrigation monitoring programs and drip irrigation have significantly improved the -- the irrigation use efficiency in this valley.

May4

Page 490. LOS HUERTOS: I would say that, in general, growers need to be investing more in having better and more sophisticated irrigation fertility management,

Exhibit 8

2006 Management Practice Checklist Update Summary Report

June 2007

State of California

REGIONAL WATER QUALITY CONTROL BOARD

Central Coast Region (3)

Table of Contents

Tables

Figures

Appendices

Introduction

The purpose of the 2006 Management Practice Checklist Update Report (2006 update report) is to summarize water quality management practice implementation reported by irrigated commercial farming operations (growers) in the Central Coast Region. Discharges from irrigated lands to surface and ground water are regulated in the Central Coast Region by the Conditional Wavier for Discharges from Irrigated Lands (conditional waiver), Order No. R3-2004-0117. The Central Coast Regional Water Quality Control Board (Water Board) adopted the conditional waiver on July 9, 2004, for a five-year cycle.

Upon enrollment, growers are required to submit a management practice checklist (checklist). In addition, growers must submit an update of the checklist at least once during the five-year cycle of the conditional waiver. The checklist is a short questionnaire that allows growers to identify planned or implemented farm water quality management practices. All enrolled growers were required to submit updated checklists by January 1, 2007. The checklist is included as Appendix A.

Methods

Determining Goals for the Checklist

One of the initial steps in the planning process for the checklist was to establish its goals. Some goals were outlined in the conditional waiver while others were outlined by Water Board staff. Additional goals were submitted by interested parties such as education and outreach coordinators and growers. A summary of the checklist goals is listed below.

Checklist Goals for the Conditional Waiver

- Establish the management practice checklist as a short questionnaire that allows the grower to identify management practices that are being planned and/or implemented for water quality protection.
- Allow growers to add practices that are known to or are likely to have a water quality benefit.
- Use the checklist to assess whether practices need to be adjusted or increased based on where water quality problems have been identified.

Checklist Goals from Water Board Staff

- Document management practices at the site level (e.g., ranches and farms) so that relationships between management practices and water quality can be examined.
- Make the checklist form easy to use and submit.
- Track management practices that benefit water quality and are applicable to irrigated agriculture in the Central Coast Region.

- Identify where to focus future outreach.
- Document progress towards achieving a Regional Water Quality Control Board long-term goal that, by 2025, 80% of the land within any watershed is properly managed to support a healthy functioning watershed, with the remaining 20% achieving positive trends.

Checklist Goals from Interested Parties

- Determine the amount of management practice implementation throughout the region and in the various counties and major watersheds.
- Make the checklist available to non-English speakers.

Developing the Management Practice Checklist

The practice reporting form was designed to determine the level of implementation for four types of farm water quality management practices: pesticide management, irrigation water management, erosion and sediment management, and nutrient management. Checklist questions were directed at the grower/operation level so that growers could submit only one checklist for their entire operation and not for each ranch site. This was done to simplify the submittal process for growers and the processing time for staff.

Delivering and Submitting the Checklist

On December 5, 2006, checklists were mailed to 1,775 enrolled growers who represent approximately 400,000 commercially irrigated acres in the Central Coast Region. The submittal due date was previously established in the conditional waiver as January 1, 2007. However, for inclusion in this report, late submittals were accepted until January 18, 2007.

Data Tabulation

The checklist responses submitted to the Water Board were entered into an Access database along with the growers' Conditional Waiver enrollment records. Database tables were queried and the results exported to Excel spreadsheets for processing into tables and graphs presented in this report.

Reporting the Results

The results of the checklist were processed into two primary formats. The first was by percent of responding growers and the second was by percent of represented acres.

Percent of Responding Growers

The percent of responding growers was defined as the number of grower responses at a particular type of implementation, divided by the total number of responding growers, multiplied by 100. For example, 1,040 growers responded by submitting a checklist. Of these, 771 growers implemented an Integrated Pest Management Program (question

P_1). Therefore, 74.1% of responding growers had implemented an Integrated Pest Management Program.

The growers were also separated into groups based on the major crop type farmed. Some growers farmed more than one crop type; in this situation the major crop type was establish as the one reported with the largest acreage.

Represented Acreage
The represented acreage was defined as the crop acreage farmed by growers who responded to the checklist. For example, a grower who responded to question P_1 of the checklist that they had implemented an Integrated Pest Management Program (IPM) and farms 100 acres of vineyard and 50 acres of row crops would have 150 represented acres as having IPM implemented.

Percent of Represented Acreage
The percent of represented acreage was defined as the represented acreage at a particular level of implementation divided by the total represented acreage times 100. For example, in question P_1, the total represented row crop acreage for the Central Coast Region is 287,533 and the implemented represented row crop acreage is 165,744, which represents 90.8% of the represented crop acreage.

Survey Limitations

This report presents the number and percentage of growers who responded to the checklist. It also presents the represented acreage of the grower. It does not present the actual acreage of implementation affected by a management practice.

Factors limiting the accuracy of the data include:

- The actual acreage for each type of response is difficult to capture using a self-reporting checklist because the checklist asked growers the level of implementation for each management practice, not the amount of acreage associated with each level of implementation.
- The actual acreage implemented is likely significantly less than the represented acreage that was recorded in this report due to most practices not being implemented across the entire operation. Also, the checklist responses were for the entire operation and did not assess implementation on an individual ranch level.
- The checklist was a self-assessment survey; the responses may vary based on the growers' interpretation of the questions and understanding of the management practices.
- The crop data for each grower was reported at the time the grower enrolled and acreage may have changed from the time of enrollment to the time when the checklist was completed. It was estimated that this was not a significant amount of error because of an acreage update for all growers collected two months prior to the checklist.

Results

This report presents the results of the checklist in two broad categories. One is by the represented crop acreage in the major counties in the region and the entire region. The other is by the responses and represented acreage for each management practice.

Represented Crop Acreage in Major Counties and Entire Region

The county with greatest total represented crop acreage was Monterey County with 147,351 acres (refer to Table 1). 71% of the crop acreage in Monterey County was reported as row crop. In the entire region the largest percentage of represented crop acreage was row crop at 66% followed by vineyard at 28% (refer to Figure 1).

Table 1
Represented Crop Acreage by Major Counties and Region Totals

	Row Crop		Orchard		Vineyard		Nursery		Greenhouse		Other		Total	
County	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Monterey	104,330	71%	1,431	1%	41,499	28%	144	<1%	247	<1%	6,948	5%	147,651	100%
San Benito	16,030	86%	1,790	10%	701	4%	1	<1%	49	<1%	805	4%	18,571	100%
San Luis Obispo	7,700	28%	2,839	10%	16,780	60%	327	1%	92	<1%	3,496	13%	27,738	100%
Santa Barbara	32,074	58%	6,779	12%	15,648	28%	247	<1%	236	<1%	870	2%	54,984	100%
Santa Clara	3,921	71%	678	12%	785	14%	69	1%	57	1%	632	11%	5,510	100%
Santa Cruz	13,192	88%	1,314	9%	122	1%	161	1%	255	2%	827	5%	15,044	100%
Entire Region	177,247	66%	14,831	6%	75,535	28%	949	<1%	936	<1%	13,578	5%	269,498	100%

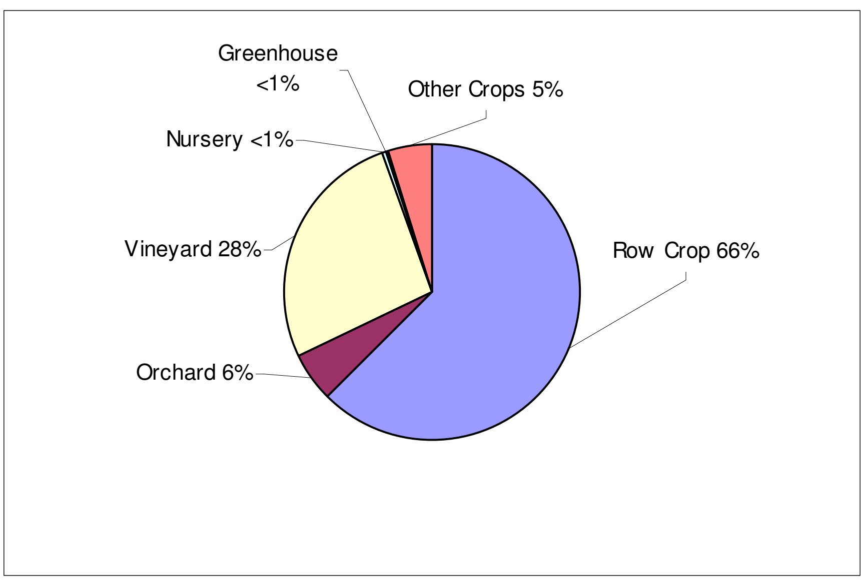

Figure 1: Percentage of represented crop acreage in the entire region.

Responses and Represented Acreage for each Management Practice Reported

The results in this section are organized in the same format as the questions were in the checklist (refer to Appendix A). The results are organized by four management practice categories: pesticide management, irrigation water management, erosion and sediment control management, and nutrient management. For each category, summary graphs show levels of implementation of each management practices for both responding growers and represented acreage (in percentage).

Pesticide Management

Pesticide management questions are listed below. The responses for all crop types to the individual questions follow in the summary graphs (refer to Figures 2 and 3). The responses by growers to each pesticide management question are outlined by major crop type along with the represented acreage.

Pesticide Management Questions

P_1) Is an integrated Pest Management program established?

P_2) Are pest populations assessed and pesticides applied based on scouting data, thresholds, and/or risk assessment models?

P_3) Are introduced or managed biological control agents utilized?

P_4) Does pesticide selection consider runoff or leaching potential?

P_5) Does pesticide selection consider toxicity to non-target organisms?

P_6) Is pesticide application equipment regularly inspected, maintained, and calibrated to ensure appropriate application rates and distributions?

P_7) Is yearly pesticide training provided for all pesticide handlers who apply, load, mix, transport, clean, and repair pesticide application equipment?

P_8) Do pesticide storage facilities have concrete pads and curbs for containment of spills?

P_9) Are pesticide mixing and loading areas located in such a manner to reduce the likelihood of a spill or overflow contaminating a water source?

P_10) Are production wells on elevated concrete bases upslope of pesticide storage and handling facilities?

P_11) Does wellhead protection consist of an elevated concrete seal, sump, or buffer area of 100' around the wellhead and a backflow prevention device?

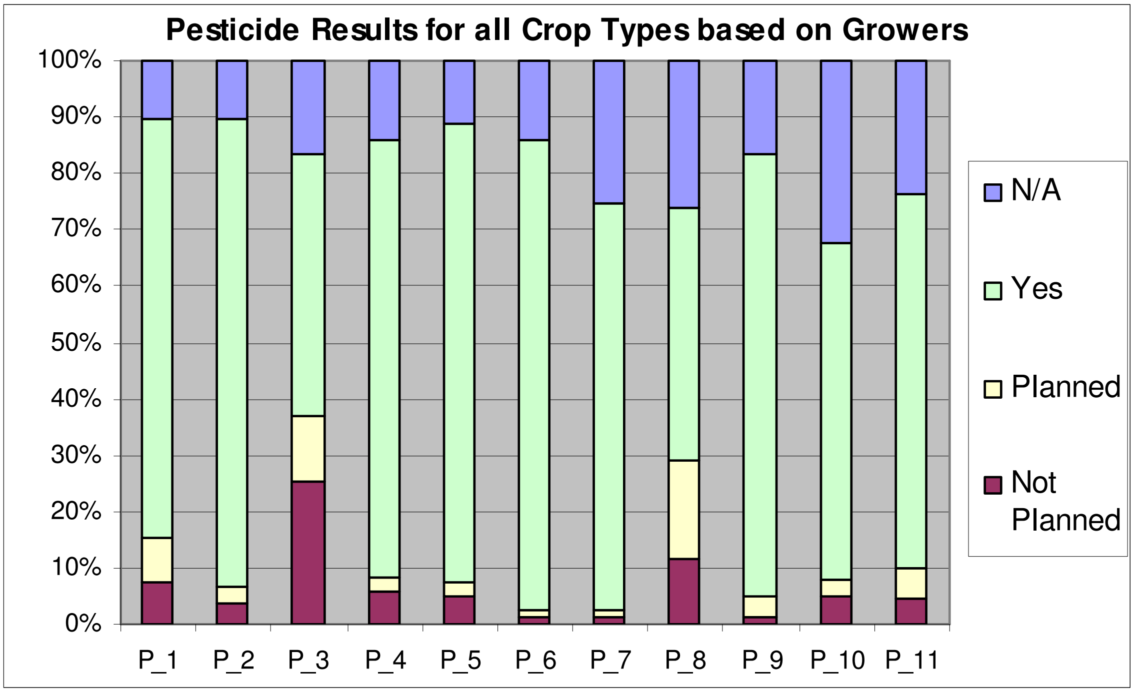

Figure 2: Level of implementation of pesticide management practices for all represented growers.

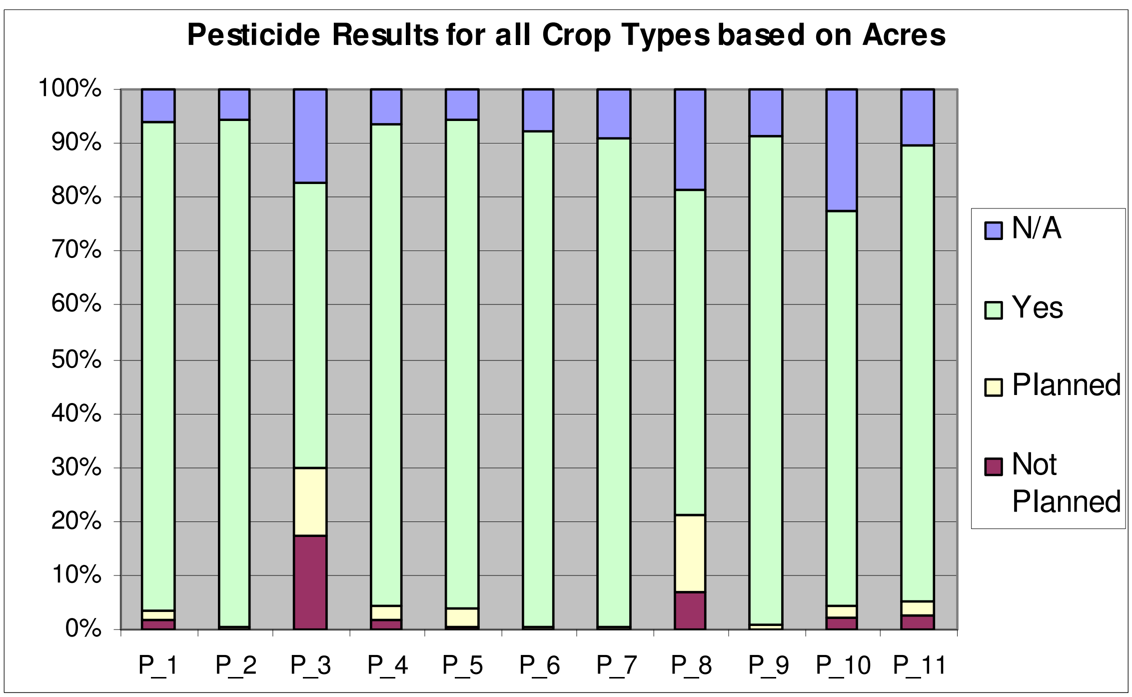

Figure 3: Level of implementation of pesticide management practices for all represented acres.

P_1) Is an Integrated Pest Management Program established?

<u>Responding Growers for all Crop Types</u>

- 74.1% (771 growers) have established an Integrated Pest Management Program.
- 7.8% (81 growers) plan implementation within three years.
- 7.6% (79 growers) do not plan to implement this practice.
- 10.5% (109 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	771	74.1	81	7.8	79	7.6	109	10.5	1,040	100
Row Crop	224	82.4	15	5.5	13	4.8	20	7.4	272	100
Orchard	168	65.9	25	9.8	26	10.2	36	14.1	255	100
Vineyard	224	77.8	27	9.4	14	4.9	23	8.0	288	100
Nursery	40	74.1	4	7.4	6	11.1	4	7.4	54	100
Greenhouse	34	64.1	3	5.7	5	9.4	11	20.8	53	100
Other	42	64.6	3	4.6	11	16.9	9	13.8	65	100

<u>Represented Irrigated Acreage for all Crop Types</u>

- Growers representing 90.5% (260,078 acres) have established an Integrated Pest Management Program.
- Growers representing 1.5% (4,332 acres) plan implementation within three years.
- Growers representing 1.8% (5,305 acres) do not plan to implement this practice.
- Growers representing 6.2% (17,818 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	260,078	90.5	4,332	1.5	5,305	1.8	17,818	6.2	287,533	100
Row Crop	165,744	90.8	1980	1.1	5,636	3.1	9163	5.0	182,523	100
Orchard	13,914	84.5	1221	7.4	559	3.4	781	4.7	16,475	100
Vineyard	72,884	90.0	701	0.9	244	0.3	7157	8.8	80,986	100
Nursery	841	84.1	76	7.6	65	6.5	18	1.8	1,000	100
Greenhouse	803	81.7	36	3.7	79	8.0	65	6.6	983	100
Other	14,039	92.8	351	2.3	289	1.9	454	3.0	15,133	100

P_2) Are pest populations assessed and pesticides applied based on scouting data, thresholds, and/or risk assessment models?

Responding Growers for all Crop Types

- 83.1% (864 growers) assess pest populations and apply pesticides based on scouting data, thresholds, and/or risk assessment models.
- 2.7% (28 growers) plan implementation within three years.
- 3.8% (39 growers) do not plan to implement this practice.
- 10.5% (109 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	864	83.1	28	2.7	39	3.8	109	10.5	1,040	100
Row Crop	234	86.0	8	2.9	4	1.5	26	9.6	272	100
Orchard	198	77.6	4	1.6	15	5.9	38	14.9	255	100
Vineyard	254	88.2	8	2.8	9	3.1	17	5.9	288	100
Nursery	45	83.3	1	1.9	4	7.4	4	7.4	54	100
Greenhouse	42	79.2	3	5.7	1	1.9	7	13.2	53	100
Other	50	76.9	1	1.5	2	3.1	12	18.5	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 93.9% (270,076 acres) assess pest populations and apply pesticides based on scouting data, thresholds, and/or risk assessment models.
- Growers representing 0.4% (1,154 acres) plan implementation within three years.
- Growers representing 0.2% (504 acres) do not plan to implement this practice.
- Growers representing 5.5% (15,799 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	270,076	93.9	1,154	0.4	504	0.2	15,799	5.5	287,533	100
Row Crop	173,686	95.2	884	0.5	238	0.1	7,715	4.2	182,523	100
Orchard	15,499	94.1	194	1.2	158	0.9	624	3.8	16,475	100
Vineyard	73,637	90.9	106	0.1	58	0.01	7,185	8.9	80,986	100
Nursery	928	92.8	3	0.3	50	5.0	19	1.9	1,000	100
Greenhouse	919	93.5	39	5.0	8	0.8	17	1.7	983	100
Other	14,657	96.9	14	0.09	13	0.09	449	3.0	15,133	100

P_3) Are introduced or managed biological control agents utilized?

Responding Growers for all Crop Types

- 46.3% (481 growers) utilize introduced or managed biological control agents.
- 11.9% (124 growers) plan implementation within three years.
- 25.2% (262 growers) do not plan to implement this practice.
- 16.6% (173 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	481	46.3	124	11.9	262	25.2	173	16.6	1,040	100
Row Crop	138	50.7	28	10.3	62	22.8	44	16.2	272	100
Orchard	107	41.9	30	11.8	65	25.5	53	20.8	255	100
Vineyard	131	45.5	44	15.3	73	25.3	40	13.9	288	100
Nursery	27	50.0	6	11.1	14	25.9	7	13.0	54	100
Greenhouse	22	41.5	6	11.3	15	28.3	10	18.9	53	100
Other	28	43.1	5	7.7	17	26.1	15	23.1	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 52.9% (152,075 acres) utilize introduced or managed biological control agents.
- Growers representing 12.5% (36,017 acres) plan implementation within three years.
- Growers representing 17.4% (50,046 acres) do not plan to implement this practice.
- Growers representing 17.2% (49,395 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	152,075	52.9	36017	12.5	50,046	17.4	49,395	17.2	287,533	100
Row Crop	112,215	61.5	16125	8.8	31,759	17.4	22424	12.3	182,523	100
Orchard	8,855	53.7	2236	13.6	3,412	20.7	1972	12.0	16,475	100
Vineyard	25,537	31.5	17314	21.4	13,337	16.5	24798	30.6	80,986	100
Nursery	435	43.5	239	23.9	223	22.3	103	10.3	1,000	100
Greenhouse	673	53.7	34	2.7	242	19.3	304	24.3	983	100
Other	11,995	79.2	783	5.2	1,388	9.2	967	6.4	15,133	100

P_4) Does pesticide selection consider runoff or leaching potential?

Responding Growers for all Crop Types

- 77.6% (807 growers) consider runoff or leaching potential with pesticide selection.
- 2.4% (25 growers) plan implementation within three years.
- 5.7% (59 growers) do not plan to implement this practice.
- 14.3% (149 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	807	77.6	25	2.4	59	5.7	149	14.3	1,040	100
Row Crop	218	80.2	11	4.0	9	3.3	34	12.5	272	100
Orchard	183	71.8	5	2.0	15	5.8	52	20.4	255	100
Vineyard	241	83.7	6	2.1	20	6.9	21	7.3	288	100
Nursery	45	83.3	0	0.0	3	5.6	6	11.1	54	100
Greenhouse	32	60.4	2	3.8	6	11.3	13	24.5	53	100
Other	47	72.3	1	1.5	5	7.7	12	18.5	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 89.2% (256,520 acres) consider runoff or leaching potential with pesticide selection.
- Growers representing 2.6% (7,694 acres) plan implementation within three years.
- Growers representing 1.7% (4,897 acres) do not plan to implement this practice.
- Growers representing 6.4% (18,422 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	256,520	89.2	7,694	2.6	4,897	1.7	18,422	6.4	287,533	100
Row Crop	162,043	88.8	6,364	3.5	3,890	2.1	10,226	5.6	182,523	100
Orchard	14,922	90.6	287	1.7	225	1.4	1,041	6.3	16,475	100
Vineyard	72,801	89.9	679	0.8	556	0.7	6,950	8.6	80,986	100
Nursery	915	91.5	4	0.4	37	3.7	44	4.4	1,000	100
Greenhouse	790	80.4	6	0.6	49	5.0	138	14.0	983	100
Other	14,290	94.4	273	1.8	148	1.0	422	2.8	15,133	100

P_5) Does pesticide selection consider toxicity to non-target organisms?

Responding Growers for all Crop Types

- 81.2% (844 growers) consider toxicity to non-target organisms with pesticide selection.
- 2.5% (26 growers) plan implementation within three years.
- 5.0% (52 growers) do not plan to implement this practice.
- 11.3% (118 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	844	81.2	26	2.5	52	5.0	118	11.3	1,040	100
Row Crop	231	84.9	11	4.0	7	2.6	23	8.5	272	100
Orchard	198	77.6	1	0.4	11	4.3	45	17.7	255	100
Vineyard	246	85.4	8	2.8	18	6.3	16	5.5	288	100
Nursery	45	83.3	1	1.9	3	5.6	5	9.2	54	100
Greenhouse	30	56.6	3	5.6	10	18.9	10	18.9	53	100
Other	51	78.5	1	1.5	2	3.1	11	16.9	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 90.3% (259,779 acres) consider toxicity to non-target organisms with pesticide selection.
- Growers representing 3.5% (10,134 acres) plan implementation within three years.
- Growers representing 0.5% (1,300 acres) do not plan to implement this practice.
- Growers representing 5.7% (16,320 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	259,779	90.3	10,134	3.5	1,300	0.5	16,320	5.7	287,533	100
Row Crop	163,698	89.7	9,920	5.4	538	0.3	8,367	4.6	182,523	100
Orchard	15,476	93.9	35	0.2	173	1.1	791	4.8	16,475	100
Vineyard	73,455	90.7	145	0.2	512	0.6	6,874	8.5	80,986	100
Nursery	916	91.6	20	2.0	35	3.5	29	2.9	1,000	100
Greenhouse	859	87.4	11	1.1	70	7.1	43	4.4	983	100
Other	14,766	97.6	37	0.2	17	0.1	313	2.1	15,133	100

P_6) Is pesticide application equipment regularly inspected, maintained, and calibrated to ensure appropriate application rates and distribution?

Responding Growers for all Crop Types

- 83.4% (867 growers) regularly inspect, maintain, and calibrate pesticide application equipment to ensure appropriate application.
- 1.3% (14 growers) plan implementation within three years.
- 1.3% (13 growers) do not plan to implement this practice.
- 14.0% (146 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	867	83.4	14	1.3	13	1.3	146	14.0	1,040	100
Row Crop	232	85.3	4	1.5	1	0.4	35	12.8	272	100
Orchard	183	71.8	4	1.6	6	2.4	62	24.2	255	100
Vineyard	264	91.7	5	1.7	3	1.0	16	5.6	288	100
Nursery	46	85.2	0	0.0	2	3.7	6	11.1	54	100
Greenhouse	47	88.7	0	0.0	0	0.0	6	11.3	53	100
Other	51	78.5	1	1.5	1	1.5	12	18.5	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 91.9% (264,171 acres) regularly inspect, maintain, and calibrate pesticide application equipment to ensure appropriate application.
- Growers representing 0.2% (548 acres) plan implementation within three years.
- Growers representing 0.04% (132 acres) do not plan to implement this practice.
- Growers representing 7.9% (22,682 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	264,171	91.9	548	0.2	132	0.04	22,682	7.9	287,533	100
Row Crop	167,791	91.9	348	0.2	14	0.008	14,370	7.9	182,523	100
Orchard	15,159	92.0	154	0.9	68	0.4	1,094	6.7	16,475	100
Vineyard	74,030	91.4	84	0.1	11	0.01	6,861	8.5	80,986	100
Nursery	936	93.6	0	0.0	29	2.9	35	3.5	1,000	100
Greenhouse	956	97.3	6	0.6	6	0.6	15	1.5	983	100
Other	14,607	96.5	12	0.08	6	0.04	508	3.4	15,133	100

P_7) Is yearly pesticide training provided for all pesticide handlers who apply, load, mix, transport, clean, and repair pesticide application equipment?

Responding Growers for all Crop Types

- 72.4% (753 growers) provide yearly pesticide training for all pesticide handlers.
- 1.1% (11 growers) plan implementation within three years.
- 1.3% (14 growers) do not plan to implement this practice.
- 25.2% (262 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	753	72.4	11	1.1	14	1.3	262	25.2	1,040	100
Row Crop	224	82.4	1	0.4	2	0.7	45	16.5	272	100
Orchard	144	56.4	3	1.2	6	2.4	102	40.0	255	100
Vineyard	224	77.8	4	1.4	3	1.0	57	19.8	288	100
Nursery	43	79.6	0	0.0	1	1.9	10	18.5	54	100
Greenhouse	45	84.9	1	1.9	0	0.0	7	13.2	53	100
Other	40	61.5	1	1.5	2	3.1	22	33.9	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 90.7% (260,818 acres) provide yearly pesticide training for all pesticide handlers.
- Growers representing 0.3% (767 acres) plan implementation within three years.
- Growers representing 0.1% (250 acres) do not plan to implement this practice.
- Growers representing 8.9% (25,698 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	260,818	90.7	767	0.3	250	0.09	25,698	8.9	287,533	100
Row Crop	166,522	91.2	200	0.1	21	0.01	15,780	8.6	182,523	100
Orchard	14,333	87.0	518	3.2	140	0.8	1,484	9.0	16,475	100
Vineyard	73,375	90.6	105	0.1	4	0.005	7,502	9.3	80,986	100
Nursery	932	93.2	0	0.0	24	2.4	44	4.4	1,000	100
Greenhouse	957	97.4	1	0.1	7	0.7	18	1.8	983	100
Other	13,719	90.7	32	0.2	77	0.5	1305	8.6	15,133	100

P_8) Do pesticide storage facilities have concrete pads and curbs for containment of spills?

Responding Growers for all Crop Types

- 44.6% (464 growers) have pesticide storage facilities with concrete pads and curbs for containment of spills.
- 17.5% (182 growers) plan implementation within three years.
- 11.7% (122 growers) do not plan to implement this practice.
- 26.2% (272 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	464	44.6	182	17.5	122	11.7	272	26.2	1,040	100
Row Crop	142	52.2	37	13.6	21	7.7	72	26.5	272	100
Orchard	94	36.9	36	14.1	33	12.9	92	36.1	255	100
Vineyard	137	47.6	58	20.1	31	10.8	62	21.5	288	100
Nursery	24	44.4	10	18.5	9	16.7	11	20.4	54	100
Greenhouse	25	47.2	14	26.4	8	15.1	6	11.3	53	100
Other	24	36.9	16	24.6	9	13.9	16	24.6	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 60.4% (173,649 acres) have pesticide storage facilities with concrete pads and curbs for containment of spills.
- Growers representing 14.4% (41,547 acres) plan implementation within three years.
- Growers representing 6.8% (19,461 acres) do not plan to implement this practice.
- Growers representing 18.4% (52,876 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	173,649	60.4	41,547	14.4	19,461	6.8	52,876	18.4	287,533	100
Row Crop	104,090	57.0	21,513	11.8	16,033	8.8	40,887	22.4	182,523	100
Orchard	7,990	48.5	4,488	27.2	1,885	11.5	2,112	12.8	16,475	100
Vineyard	53,503	66.1	12,763	15.8	4,556	5.5	10,164	12.6	80,986	100
Nursery	472	47.2	345	34.5	112	11.2	71	7.1	1,000	100
Greenhouse	460	46.8	384	39.1	116	11.8	23	2.3	983	100
Other	8,497	56.1	4,307	28.5	692	4.6	1,637	10.8	15,133	100

P_9) Are pesticide mixing and loading areas located in such a manner to reduce the likelihood of a spill or overflow contaminating a water source?

Responding Growers for all Crop Types

- 78.7% (818 growers) locate pesticide mixing and loading areas to reduce the likelihood of a spill or overflow contaminating a water source.
- 3.7% (39 growers) plan implementation within three years.
- 1.1% (11 growers) do not plan to implement this practice.
- 16.5% (172 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	818	78.7	39	3.7	11	1.1	172	16.5	1,040	100
Row Crop	220	80.9	5	1.8	1	0.4	46	16.9	272	100
Orchard	170	66.7	13	5.1	4	1.5	68	26.7	255	100
Vineyard	247	85.8	16	5.5	2	0.7	23	8.0	288	100
Nursery	43	79.6	1	1.9	2	3.7	8	14.8	54	100
Greenhouse	42	79.2	3	5.7	1	1.9	7	13.2	53	100
Other	52	80.0	1	1.5	1	1.5	11	17.0	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 90.1% (259,195 acres) locate pesticide mixing and loading areas to reduce the likelihood of a spill or overflow contaminating a water source.
- Growers representing 1.0% (2,856 acres) plan implementation within three years.
- Growers representing 0.07% (203 acres) do not plan to implement this practice.
- Growers representing 8.8% (25,279 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	259,195	90.1	2,856	1.0	203	0.07	25,279	8.8	287533	100
Row Crop	164,627	90.2	1,050	0.6	15	0.008	16,831	9.2	182,523	100
Orchard	14,458	87.8	790	4.8	64	0.4	1,163	7.1	16,475	100
Vineyard	73,029	90.2	955	1.2	86	0.1	6,916	8.5	80,986	100
Nursery	928	92.8	6	0.6	27	2.7	39	3.9	1,000	100
Greenhouse	789	80.3	71	7.2	8	0.8	115	11.7	983	100
Other	14,460	95.6	196	1.3	7	0.05	470	3.1	15,133	100

P_10) Are production wells on elevated concrete bases upslope of pesticide storage and handling facilities?

Responding Growers for all Crop Types

- 60.0% (624 growers) have production wells on elevated concrete bases upslope of pesticide storage and handling facilities.
- 2.8% (29 growers) plan implementation within three years.
- 4.9% (51 growers) do not plan to implement this practice.
- 32.3% (336 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	624	60.0	29	2.8	51	4.9	336	32.3	1,040	100
Row Crop	189	69.5	8	2.9	8	2.9	67	24.6	272	100
Orchard	116	45.5	6	2.4	10	3.9	123	48.2	255	100
Vineyard	181	62.8	12	4.2	24	8.3	71	24.7	288	100
Nursery	30	55.6	0	0.0	1	1.9	23	42.6	54	100
Greenhouse	39	73.6	3	5.7	2	3.8	9	17.0	53	100
Other	41	63.1	0	0.0	4	6.2	20	30.8	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 73.3% (210,873 acres) have production wells on elevated concrete bases upslope of pesticide storage and handling facilities.
- Growers representing 2.2% (6,198 acres) plan implementation within three years.
- Growers representing 2.2% (6,402 acres) do not plan to implement this practice.
- Growers representing 22.3% (64,060 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	210,873	73.3	6,198	2.2	6,402	2.2	64,060	22.3	287,533	100
Row Crop	143,432	78.6	1,527	0.8	3,080	1.7	34,484	18.9	182,523	100
Orchard	10,327	62.7	1,298	7.9	559	3.4	4,291	26.0	16,475	100
Vineyard	50,209	62.0	3,033	3.7	2,554	3.1	25,190	31.1	80,986	100
Nursery	594	59.4	7	0.7	181	18.1	218	21.8	1,000	100
Greenhouse	745	75.8	55	5.6	10	1.0	173	17.6	983	100
Other	12,959	85.6	1	0.007	186	1.2	1,987	13.1	15,133	100

P_11) Does wellhead protection consist of an elevated concrete seal, sump, or buffer area of 100' around the wellhead and a backflow prevention device?

Responding Growers for all Crop Types

- 66.3% (690 growers) provide wellhead protection through an elevated concrete seal, sump, or buffer area of 100' around the wellhead and a backflow prevention device.
- 5.4% (56 growers) plan implementation within three years.
- 4.5% (47 growers) do not plan to implement this practice.
- 23.8% (247 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	690	66.3	56	5.4	47	4.5	247	23.8	1,040	100
Row Crop	218	80.1	16	5.9	10	3.7	28	10.3	272	100
Orchard	125	49.0	9	3.5	14	5.5	107	42.0	255	100
Vineyard	205	71.2	18	6.3	14	4.9	51	17.7	288	100
Nursery	32	59.3	3	5.6	3	5.6	16	29.6	54	100
Greenhouse	38	71.7	4	7.5	0	0.0	11	20.8	53	100
Other	44	67.7	4	6.1	3	4.6	14	21.5	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 84.1% (241,680 acres) provide wellhead protection through an elevated concrete seal, sump, or buffer area of 100' around the wellhead and a backflow prevention device.
- Growers representing 2.8% (8,055 acres) plan implementation within three years.
- Growers representing 2.6% (7,493 acres) do not plan to implement this practice.
- Growers representing 10.5% (30,305 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	241,680	84.1	8,055	2.8	7,493	2.6	30,305	10.5	28,7533	100
Row Crop	161,752	88.6	5710	3.1	2,443	1.3	12618	6.9	182,523	100
Orchard	11,302	68.6	811	4.9	1,372	8.3	2990	18.1	16,475	100
Vineyard	60,582	74.8	1178	1.5	3,173	3.9	16053	19.8	80,986	100
Nursery	632	63.2	15	1.5	208	20.8	145	14.5	1,000	100
Greenhouse	789	80.3	51	5.2	17	1.7	126	12.8	983	100
Other	13,490	89.1	502	3.3	202	1.3	939	6.2	15,133	100

Irrigation Water Management

The questions for this section are listed below. The responses for all crop types to the individual questions follow in the summary graphs (refer to Figures 4 and 5). The responses by growers to each irrigation water management question are outlined by major crop type along with the represented acreage.

Irrigation Water Management Questions

I_1) Is drip irrigation distribution uniformity maximized and maintained through regular system equipment and system pressure maintenance?

I_2) Is sprinkler and micro-sprinkler irrigation distribution uniformity maximized and maintained through regular system pressure maintenance and water application during low wind conditions?

I_3) Is furrow and flood irrigation distribution uniformity maximized and maintained by either managing furrow lengths, installing surge irrigation valves, installing irrigation field ditches, or using alternate row irrigation?

I_4) Is your irrigation system design optimized by matching sprinkler nozzle/drip applicator flow rates to the infiltration rate of the soil?

I_5) Are measured or published evapo-transpiration data (CIMIS) used to determine crop water use?

I_6) Is the soil water-holding capacity known?

I_7) Are records kept for each crop irrigated? (Records include the date, amount of each irrigation water applied, and the source of water used.)

I_8) Have all irrigators who apply irrigation water and maintain irrigation systems received training?

I_9) Has an irrigation mobile lab system evaluation been completed and the system been adjusted accordingly?

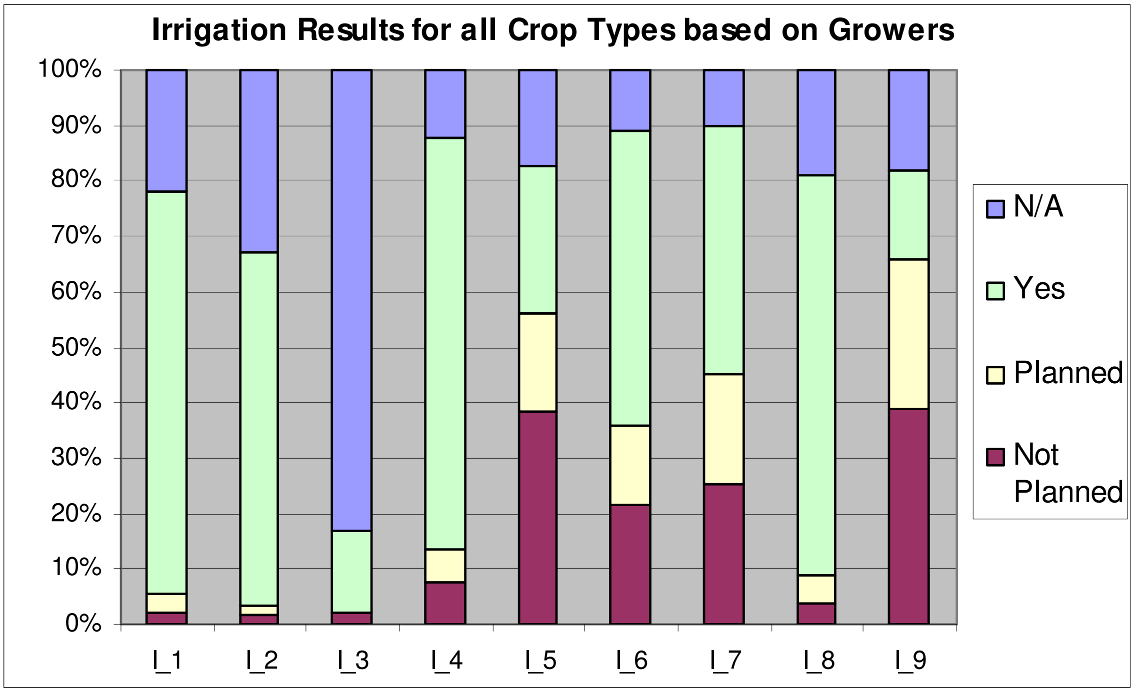

Figure 4: Level of implementation of irrigation water management practices for all represented growers.

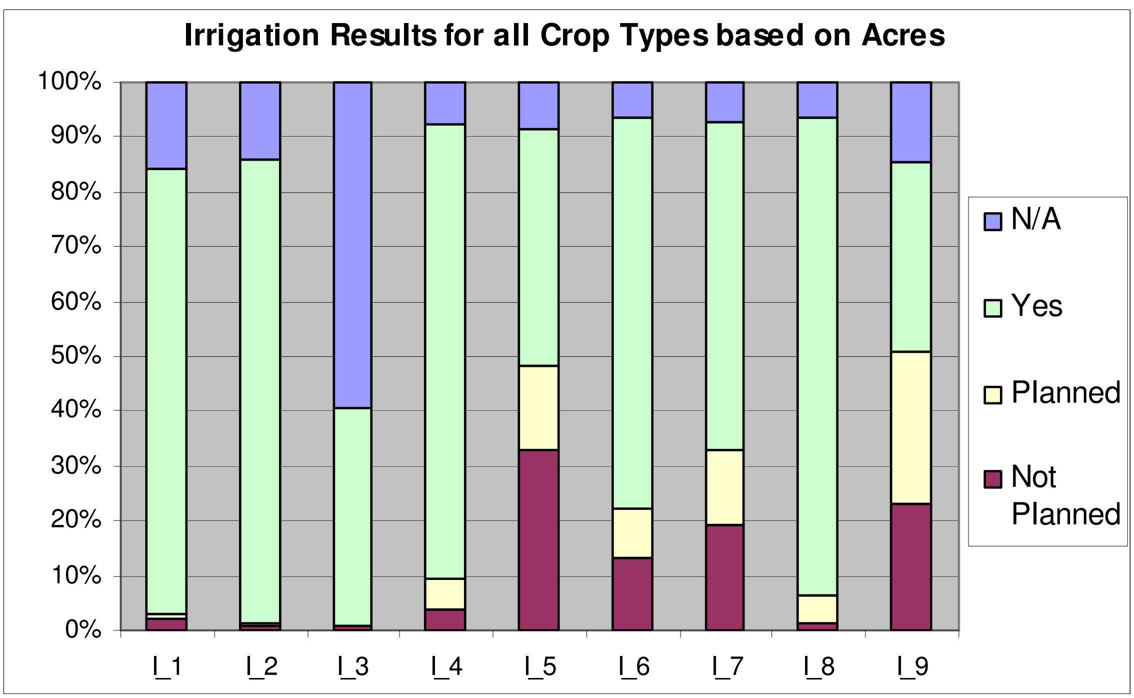

Figure 5: Level of implementation of irrigation water management practices for all represented acres.

I_1) Is drip irrigation distribution uniformity maximized and maintained through regular system equipment and system pressure maintenance?

Responding Growers for all Crop Types

- 72.7% (756 growers) maximize and maintain drip irrigation distribution uniformity.
- 3.2% (33 growers) plan implementation within three years.
- 2.2% (23 growers) do not plan to implement this practice.
- 21.9% (228 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	756	72.7	33	3.2	23	2.2	228	21.9	1,040	100
Row Crop	207	76.1	8	2.9	9	3.3	48	17.6	272	100
Orchard	145	56.9	9	3.5	7	2.7	94	36.9	255	100
Vineyard	264	91.7	11	3.8	1	0.3	12	4.2	288	100
Nursery	32	59.3	1	1.9	3	5.6	18	33.3	54	100
Greenhouse	34	64.2	1	1.9	1	1.9	17	32.1	53	100
Other	37	56.9	0	0.0	2	3.1	26	40.0	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 80.9% (232,732 acres) maximize and maintain drip irrigation distribution uniformity.
- Growers representing 1.1% (3,080 acres) plan implementation within three years.
- Growers representing 2.1% (6,022 acres) do not plan to implement this practice.
- Growers representing 15.9% (45,699 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	232,732	80.9	3,080	1.1	6,022	2.1	45,699	15.9	287,533	100
Row Crop	144,692	79.3	1,425	0.8	5,109	2.8	31,297	17.1	182,523	100
Orchard	10,819	65.7	871	5.3	391	2.4	4,394	26.7	16,475	100
Vineyard	72,848	90.0	864	1.1	181	0.2	7,093	8.8	80,986	100
Nursery	799	79.9	13	1.3	35	3.5	153	8.7	1,000	100
Greenhouse	756	76.9	5	0.5	57	5.8	165	16.8	983	100
Other	11,835	78.2	1	0.00006	249	1.6	3,048	20.1	15,133	100

I_2) Is sprinkler and micro-sprinkler irrigation distribution uniformity maximized and maintained through regular system pressure maintenance and water application during low wind conditions?

Responding Growers for all Crop Types

- 63.7% (662 growers) maximize and maintain sprinkler irrigation distribution uniformity.
- 2.0% (21 growers) plan implementation within three years.
- 1.5% (16 growers) do not plan to implement this practice.
- 32.8% (341 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	662	63.7	21	2.0	16	1.5	341	32.8	1,040	100
Row Crop	223	82.0	4	1.5	5	1.8	40	14.7	272	100
Orchard	204	80.0	10	3.9	2	0.8	39	15.3	255	100
Vineyard	99	34.4	1	0.3	4	1.4	184	63.9	288	100
Nursery	36	66.7	2	3.7	2	3.7	14	25.9	54	100
Greenhouse	33	62.3	1	1.9	1	1.9	18	34.0	53	100
Other	40	61.5	3	4.6	1	1.5	21	32.3	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 84.6% (243,349 acres) maximize and maintain sprinkler irrigation distribution uniformity.
- Growers representing 0.4% (1,087 acres) plan implementation within three years.
- Growers representing 1.0% (2,822 acres) do not plan to implement this practice.
- Growers representing 14.0% (40,275 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	243,349	84.6	1,087	0.4	2,822	1.0	40,275	14.0	287,533	100
Row Crop	168,525	92.3	467	0.3	1,742	1.0	11,789	6.5	182,523	100
Orchard	14,259	86.5	554	3.4	101	0.6	1,561	9.5	16,475	100
Vineyard	53,489	66.0	21	0.02	893	1.1	26,583	32.8	80,986	100
Nursery	770	77.0	30	3.0	31	3.1	169	16.9	1,000	100
Greenhouse	838	85.2	10	1.0	17	1.8	118	12.0	983	100
Other	13,121	86.7	58	0.4	17	0.1	1,937	12.8	15,133	100

I_3) Is furrow irrigation distribution uniformity maximized and maintained by either managing furrow lengths, installing surge irrigation valves, installing irrigation field ditches, or using alternate row irrigation?

Responding Growers for all Crop Types

- 14.4% (150 growers) maximize and maintain furrow irrigation distribution uniformity.
- 0.3% (3 growers) plan implementation within three years.
- 2.0% (21 growers) do not plan to implement this practice.
- 83.3% (866 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	150	14.4	3	0.3	21	2.0	866	83.3	1,040	100
Row Crop	119	43.8	2	0.7	5	1.8	146	53.7	272	100
Orchard	10	3.9	0	0.0	6	2.4	239	93.7	255	100
Vineyard	7	2.4	1	0.3	4	1.4	276	95.8	288	100
Nursery	1	1.9	0	0.0	2	3.7	51	94.4	54	100
Greenhouse	4	7.5	0	0.0	1	1.9	48	90.6	53	100
Other	7	10.8	0	0.0	2	3.1	56	86.2	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 39.8% (114,423 acres) maximize and maintain furrow irrigation distribution uniformity.
- Growers representing 0.02% (54 acres) plan implementation within three years.
- Growers representing 0.8% (2,232 acres) do not plan to implement this practice.
- Growers representing 59.4% (170,824 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	114,423	39.8	54	0.02	2,232	0.8	170,824	59.4	28,533	100
Row Crop	116,451	63.8	43	0.02	1,324	0.7	64,705	35.4	182,523	100
Orchard	1,075	6.5	0	0.0	407	2.5	14,993	91.0	16,475	100
Vineyard	480	0.6	16	0.02	245	0.3	80,245	99.1	80,986	100
Nursery	42	4.2	0	0.0	28	2.8	930	93.0	1,000	100
Greenhouse	26	6.8	0	0.0	15	3.9	342	89.3	983	100
Other	2,165	14.3	0	0.0	190	1.3	12778	84.4	15,133	100

I_4) Is your irrigation system design optimized by matching sprinkler nozzle/drip applicator flow rates to the infiltration rate of the soil?

Responding Growers for all Crop Types

- 74.3% (773 growers) optimize irrigation system design by matching sprinkler nozzle/drip flow rates with infiltration rate of the soil.
- 6.1% (63 growers) plan implementation within three years.
- 7.5% (78 growers) do not plan to implement this practice.
- 12.1% (126 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	773	74.3	63	6.1	78	7.5	126	12.1	1,040	100
Row Crop	217	79.8	21	7.7	15	5.5	19	7.0	272	100
Orchard	195	76.5	19	7.5	24	9.4	17	6.7	255	100
Vineyard	226	78.5	15	5.2	19	6.6	28	9.7	288	100
Nursery	25	46.3	5	9.2	5	9.3	19	35.2	54	100
Greenhouse	29	54.7	0	0.0	4	7.5	20	37.7	53	100
Other	47	72.3	2	3.1	6	9.2	10	15.4	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 82.7% (237,884 acres) optimize irrigation system design by matching sprinkler nozzle/drip flow rates with infiltration rate of the soil.
- Growers representing 5.6% (16,003 acres) plan implementation within three years.
- Growers representing 3.9% (11,277 acres) do not plan to implement this practice.
- Growers representing 7.8% (22,369 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	237,884	82.7	16,003	5.6	11,277	3.9	22,369	7.8	287,533	100
Row Crop	158,225	86.7	7,549	4.1	7,897	4.3	8,852	4.8	182,523	100
Orchard	12,436	75.5	1,276	7.7	2,207	13.4	556	3.3	16,475	100
Vineyard	59,400	73.3	7,414	9.2	2,472	3.1	11,700	14.4	80,986	100
Nursery	653	65.3	58	5.8	76	7.6	213	21.3	1,000	100
Greenhouse	549	55.8	24	2.4	56	5.7	354	36.0	983	100
Other	13,713	90.6	118	0.8	206	1.4	1,096	7.2	15,133	100

I_5) Are measured or published evapo-transpiration data (CIMIS) used to determine crop water use?

Responding Growers for all Crop Types

- 26.3% (273 growers) use measured or published evapo-transpiration data to determine crop water use.
- 17.7% (184 growers) plan implementation within three years.
- 38.6% (402 growers) do not plan to implement this practice.
- 17.4% (181 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	273	26.3	184	17.7	402	38.6	181	17.4	1,040	100
Row Crop	64	23.5	56	20.6	115	42.3	37	13.6	272	100
Orchard	61	23.9	47	18.4	110	43.1	37	14.5	255	100
Vineyard	120	41.7	49	17.0	91	31.6	28	9.7	288	100
Nursery	3	5.6	6	11.1	20	37.0	25	46.3	54	100
Greenhouse	2	3.8	6	11.3	20	37.7	25	47.2	53	100
Other	9	13.8	14	21.5	27	41.5	15	23.1	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 42.9% (123,443 acres) use measured or published evapo-transpiration data to determine crop water use.
- Growers representing 15.5% (44,437 acres) plan implementation within three years.
- Growers representing 33.0% (94,884 acres) do not plan to implement this practice.
- Growers representing 8.6% (24,769 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	123,443	42.9	44,437	15.5	94,884	33.0	24,769	8.6	287,533	100
Row Crop	49,960	27.4	31,456	17.2	86,323	47.3	14,784	8.1	182,523	100
Orchard	5,582	33.9	2,347	14.2	7,281	44.2	1,265	7.7	16,475	100
Vineyard	64,872	80.1	4,325	5.3	4,374	5.4	7,415	9.2	80,986	100
Nursery	250	25.0	108	10.8	272	27.2	370	37.0	1,000	100
Greenhouse	34	3.5	156	15.9	511	52.0	282	28.7	983	100
Other	4,725	31.2	5,298	35.0	3,889	25.7	1,221	8.1	15,133	100

I_6) Is the soil water-holding capacity known?

Responding Growers for all Crop Types

- 53.3% (554 growers) know the soil water-holding capacity.
- 14.4% (150 growers) plan implementation within three years.
- 21.5% (224 growers) do not plan to implement this practice.
- 10.8% (112 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	554	53.3	150	14.4	224	21.5	112	10.8	1,040	100
Row Crop	141	51.8	44	16.2	65	23.9	22	8.1	272	100
Orchard	119	46.7	44	17.3	74	29.0	18	7.1	255	100
Vineyard	204	70.8	33	11.5	43	14.9	8	2.8	288	100
Nursery	19	35.2	5	9.3	8	14.8	22	40.7	54	100
Greenhouse	14	26.4	3	5.7	12	22.6	24	45.3	53	100
Other	32	49.2	13	20.0	12	18.5	8	12.3	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 71.2% (204,841 acres) know the soil water-holding capacity.
- Growers representing 8.9% (25,682 acres) plan implementation within three years.
- Growers representing 13.4% (38,519 acres) do not plan to implement this practice.
- Growers representing 6.4% (18,491 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	204,841	71.2	25,682	8.9	38,519	13.4	18,491	6.4	287,533	100
Row Crop	115,738	63.4	20,999	11.5	35,843	19.6	9,943	5.4	182,523	100
Orchard	8,313	50.5	2,557	15.5	4,832	29.3	773	4.7	16,475	100
Vineyard	71,339	88.1	1,997	2.5	934	1.2	6,716	8.3	80,986	100
Nursery	487	48.7	91	9.1	159	15.9	263	26.3	1,000	100
Greenhouse	283	28.8	79	8.0	262	26.6	359	36.5	983	100
Other	11,624	76.8	1,648	10.9	944	6.2	917	6.1	15,133	100

I_7) Are records kept for each crop irrigated? (Records include the date, amount of each irrigation water applied, and the source of water used)

Responding Growers for all Crop Types

- 44.9% (467 growers) keep records for each crop irrigated.
- 19.6% (204 growers) plan implementation within three years.
- 25.5% (265 growers) do not plan to implement this practice.
- 10.0% (104 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	467	44.9	204	19.6	265	25.5	104	10.0	1,040	100
Row Crop	102	37.5	73	26.8	74	27.2	23	8.5	272	100
Orchard	116	45.5	47	18.4	72	28.2	20	7.8	255	100
Vineyard	180	62.5	51	17.7	46	16.0	11	3.8	288	100
Nursery	5	9.3	8	14.8	23	42.6	18	33.3	54	100
Greenhouse	15	28.3	8	15.1	17	32.1	13	24.5	53	100
Other	24	36.9	10	15.4	21	32.3	10	15.4	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 59.9% (172,254 acres) keep records for each crop irrigated.
- Growers representing 13.5% (38,769 acres) plan implementation within three years.
- Growers representing 19.4% (55,848 acres) do not plan to implement this practice.
- Growers representing 7.2% (20,662 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	172,254	59.9	38,769	13.5	55,848	19.4	20,662	7.2	287,533	100
Row Crop	92,421	38.1	90,152	37.2	47,800	19.7	12,150	5.0	182,523	100
Orchard	9414	57.1	2,862	17.4	3,617	22.0	582	3.5	16,475	100
Vineyard	66,477	82.1	4,680	5.8	3,052	3.8	6,777	8.4	80,986	100
Nursery	388	38.8	139	13.9	276	27.6	197	19.7	1,000	100
Greenhouse	271	27.6	124	12.6	459	46.7	129	13.1	983	100
Other	9,227	61.0	1,499	9.9	3,677	24.3	730	4.8	15,133	100

I_8) Have all irrigators who apply irrigation water and maintain irrigation systems received training?

Responding Growers for all Crop Types

- 72.0% (749 growers) have trained irrigators for applying irrigation water.
- 5.1% (53 growers) plan implementation within three years.
- 3.8% (40 growers) do not plan to implement this practice.
- 19.0% (198 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	749	72.0	53	5.1	40	3.8	198	19.0	1,040	100
Row Crop	221	81.3	21	7.7	8	2.9	22	8.1	272	100
Orchard	169	66.3	13	5.1	6	2.4	67	26.3	255	100
Vineyard	217	75.3	9	3.1	6	2.1	56	19.4	288	100
Nursery	34	63.0	1	1.9	4	7.4	15	27.8	54	100
Greenhouse	31	58.5	3	5.7	6	11.3	13	24.5	53	100
Other	40	61.5	5	7.7	6	9.2	14	21.5	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 87.6% (251,771 acres) have trained irrigators for applying irrigation water.
- Growers representing 4.8% (13,785 acres) plan implementation within three years.
- Growers representing 1.4% (4,087 acres) do not plan to implement this practice.
- Growers representing 6.2% (17,890 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	251,771	87.6	13,785	4.8	4,087	1.4	17,890	6.2	287,533	100
Row Crop	160,665	88.0	10,231	5.6	2,446	1.3	9,181	5.0	182,523	100
Orchard	14,341	87.0	702	4.3	331	2.0	1,101	6.6	16,475	100
Vineyard	71,314	88.1	2,149	2.6	124	0.2	7,399	9.1	80,986	100
Nursery	833	83.3	31	3.1	58	5.8	78	7.8	1,000	100
Greenhouse	792	80.6	46	4.7	70	7.1	75	7.6	983	100
Other	12,686	83.8	810	8.4	1,146	7.6	491	3.2	15,133	100

I_9) Has an irrigation mobile lab system evaluation been completed and the system been adjusted accordingly?

Responding Growers for all Crop Types

- 16.0% (166 growers) completed an irrigation mobile lab system evaluation.
- 27.0% (281 growers) plan implementation within three years.
- 38.8% (404 growers) do not plan to implement this practice.
- 18.2% (189 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	166	16.0	281	27.0	404	38.8	189	18.2	1,040	100
Row Crop	63	23.2	87	32.0	92	33.8	30	11.0	272	100
Orchard	37	14.5	75	29.4	102	40.0	41	16.1	255	100
Vineyard	38	13.2	77	26.7	121	42.0	52	18.1	288	100
Nursery	5	9.3	13	24.1	20	37.0	16	29.6	54	100
Greenhouse	4	7.5	4	7.5	21	39.6	24	45.3	53	100
Other	12	18.5	17	26.2	24	36.9	12	18.5	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 34.3% (98,763 acres) completed an irrigation mobile lab system evaluation.
- Growers representing 28.0% (80,482 acres) plan implementation within three years.
- Growers representing 23.0% (66,243 acres) do not plan to implement this practice.
- Growers representing 14.6% (30,305 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	98,763	34.3	80,482	28.0	66,243	23.0	42,045	14.6	287,533	100
Row Crop	75,159	41.2	42,239	23.1	46,073	25.2	19,052	10.4	182,523	100
Orchard	3,903	23.7	5,148	31.2	5,524	33.5	1900	11.5	16,475	100
Vineyard	23,521	29.0	24,393	30.1	12,631	15.6	20,441	25.2	80,986	100
Nursery	220	22.0	255	25.5	299	29.9	226	22.6	1,000	100
Greenhouse	97	9.9	111	11.3	367	37.3	408	41.5	983	100
Other	5,386	35.6	6,237	41.2	2,828	18.7	682	4.5	15,133	100

Erosion and Sediment Control Management

The questions for this section are listed below. The responses for all crop types to the individual questions follow in the summary graphs (refer to Figures 6 and 7). The responses by growers to each erosion and sediment control management question are outlined by major crop type along with the represented acreage.

<u>Erosion and Sediment Control Management Questions</u>

E_1) Are cover crops used to protect bare soil from erosion during fallow cycles and to build up solid organic matter as a crop rotation?

E_2) Are hedgerows, trees, and shrubs established along field margins or between field blocks to reduce wind effects, and protect slopes from erosion?

E_3) Are farm access roads located and graded to minimize erosion potential?

E_4) Are farm access roads protected from concentrated runoff through the use of vegetative material, gravel, and/or mulch?

E_5) Are ditches and channel banks protected from concentrated flow through the use of grassed waterway, lined channels, and/or diversions?

E_6) Are field layout and row length designed to minimize erosion potential?

E_7) Are sediment basins constructed to intercept sediment-laden runoff in locations where erosion is expected and sediment is known to leave the farm?

E_8) Are water and sediment control basins used in locations where sediment and excess runoff may cause gullies or flooding problems downstream?

E_9) Are vegetative buffers implemented between cropped areas, along the lower edge of the farm, and along roadways? (*This practice is also effective in removing nutrients and pesticides from runoff*.)

E_10) Where streams cross or property, are riparian buffers established and maintained?

E_11) Are culverts properly sized and maintained?

E_12) Are implemented management practices evaluated for effectiveness (i.e. photo-point monitoring, water quality testing)?

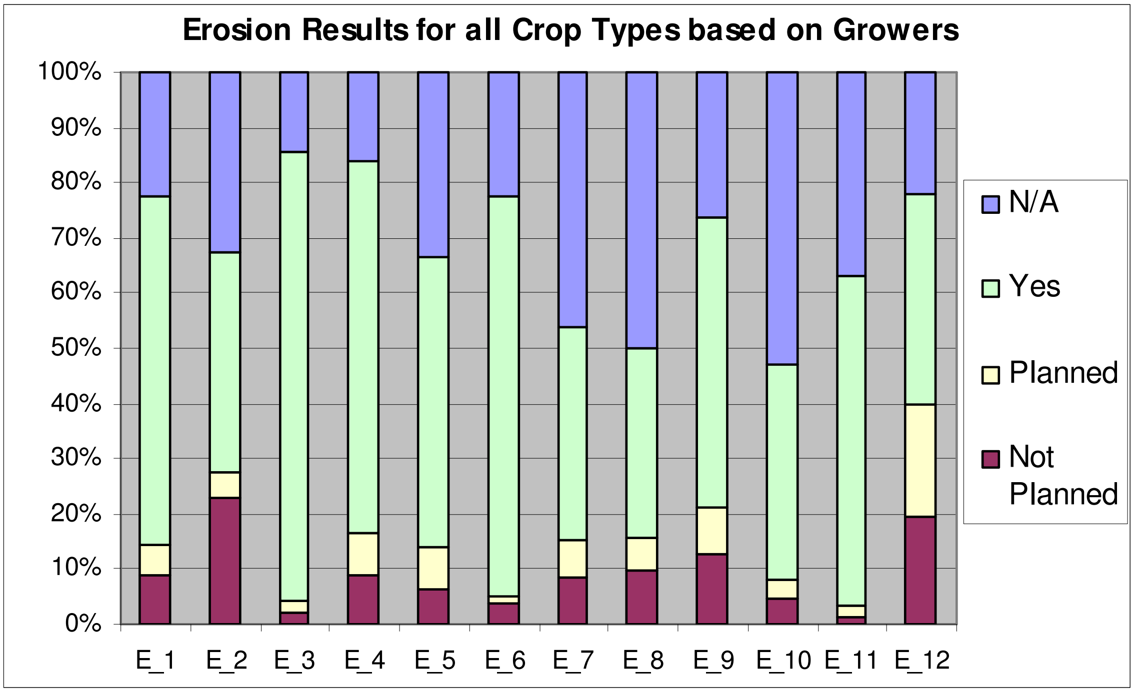

Figure 6: Level of implementation of erosion and sediment management practices for all represented growers.

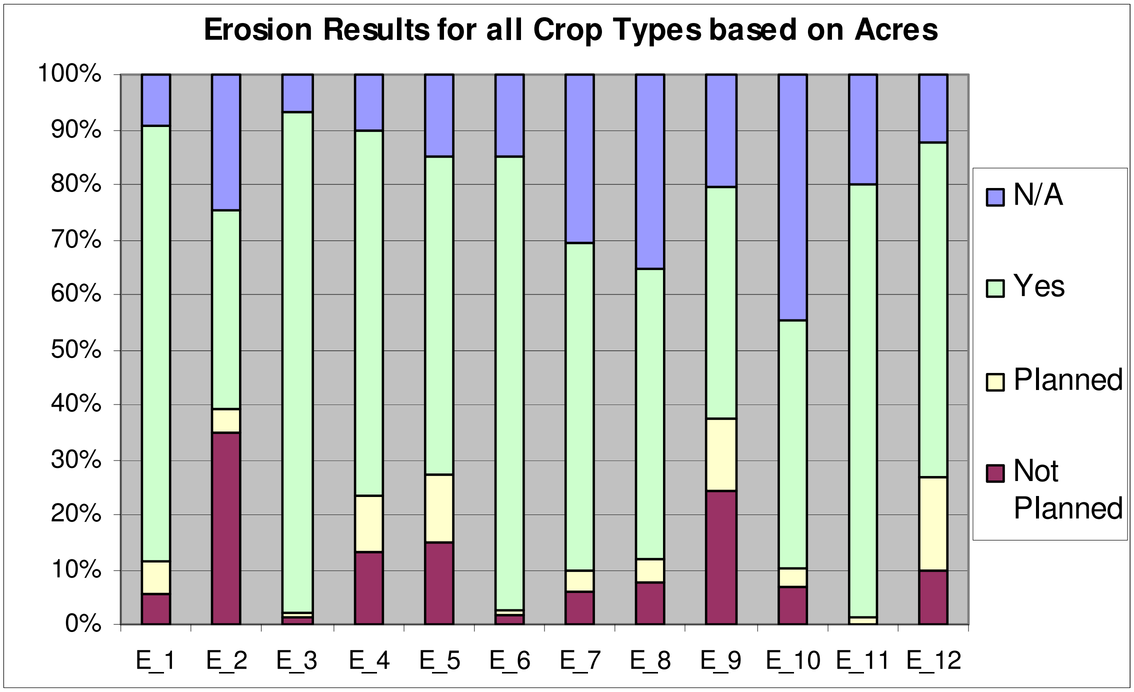

Figure 7: Level of implementation of erosion and sediment management practices for all represented acres.

E_1) Are cover crops used to protect bare soil from erosion during fallow cycles and to build up soil organic matter as a crop rotation?

Responding Growers for all Crop Types

- 63.1% (656 growers) use cover crops to protect bare soil during fallow cycles.
- 5.7% (59 growers) plan implementation within three years.
- 8.8% (92 growers) do not plan to implement this practice.
- 22.4% (233 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	656	63.1	59	5.7	92	8.8	233	22.4	1,040	100
Row Crop	191	70.2	22	8.1	27	9.9	32	11.8	272	100
Orchard	139	54.5	19	7.5	36	14.1	61	23.9	255	100
Vineyard	241	83.7	9	3.1	10	3.5	28	9.7	288	100
Nursery	12	22.2	1	1.9	3	5.6	38	70.4	54	100
Greenhouse	9	17.0	1	1.9	3	5.7	40	75.5	53	100
Other	39	60.0	5	7.7	7	10.8	14	21.5	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 79.4% (228,278 acres) use cover crops to protect bare soil during fallow cycles.
- Growers representing 5.7% (16,461 acres) plan implementation within three years.
- Growers representing 5.7% (16,464 acres) do not plan to implement this practice.
- Growers representing 9.2% (26,330 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	228,278	79.4	16,461	5.7	16,464	5.7	26,330	9.2	287,533	100
Row Crop	143,975	78.9	14,313	7.8	11,584	6.3	12,651	6.9	182,523	100
Orchard	9,145	55.5	1,335	8.1	3,761	22.8	2,234	13.6	16,475	100
Vineyard	70,313	86.8	189	0.2	746	0.9	9,738	12.0	80,986	100
Nursery	432	43.2	18	1.8	41	4.1	509	50.9	1,000	100
Greenhouse	234	23.8	64	6.5	29	3.0	656	66.7	983	100
Other	12,729	84.1	808	5.3	582	3.8	1,014	6.7	15,133	100

E_2) Are hedgerow, trees, and shrubs established along field margins or between field block to reduce wind effects and protect slopes from erosion?

Responding Growers for all Crop Types

- 40.0% (416 growers) establish hedgerows, trees, and shrubs along field margins or between field blocks.
- 4.8% (50 growers) plan implementation within three years.
- 22.7% (236 growers) do not plan to implement this practice.
- 32.5% (338 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	416	40.0	50	4.8	236	22.7	338	32.5	1,040	100
Row Crop	103	37.9	23	8.5	93	34.2	53	19.5	272	100
Orchard	108	42.4	9	3.5	45	17.6	93	36.5	255	100
Vineyard	106	36.8	11	3.8	70	24.3	101	35.1	288	100
Nursery	25	46.3	1	1.9	5	9.3	23	42.6	54	100
Greenhouse	12	22.6	1	1.9	2	3.8	38	71.7	53	100
Other	31	47.7	4	6.1	16	24.6	14	21.5	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 36.2% (104,147 acres) establish hedgerows, trees, and shrubs along field margins or between field blocks.
- Growers representing 4.4% (12,679 acres) plan implementation within three years.
- Growers representing 34.7% (99,833 acres) do not plan to implement this practice.
- Growers representing 24.6% (70,874 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	104,147	36.2	12,679	4.4	99,833	34.7	70,874	24.6	287,533	100
Row Crop	52,098	28.5	11,180	6.1	87,984	48.2	31,261	17.1	182,523	100
Orchard	5,990	36.4	285	1.7	5,402	32.8	4,798	29.1	16,475	100
Vineyard	41,252	50.9	716	0.9	8,511	10.5	30,507	37.7	80,986	100
Nursery	520	52.0	3	0.3	230	23.0	247	24.7	1,000	100
Greenhouse	348	35.4	21	2.1	54	5.5	560	57.0	983	100
Other	7,293	48.2	773	5.1	3,414	22.6	3,653	24.1	15,133	100

E_3) Are farm access roads located and graded to minimize erosion potential?

Responding Growers for all Crop Types

- 81.3% (846 growers) locate and grade farm access roads to minimize erosion potential.
- 2.2% (23 growers) plan implementation within three years.
- 2.1% (22 growers) do not plan to implement this practice.
- 14.3% (149 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	846	81.3	23	2.2	22	2.1	149	14.3	1,040	100
Row Crop	236	86.8	4	1.5	9	3.3	23	8.5	272	100
Orchard	194	76.1	7	2.7	3	1.2	51	20.0	255	100
Vineyard	249	86.5	6	2.1	4	1.4	29	10.1	288	100
Nursery	42	77.8	1	1.9	2	3.7	9	16.7	54	100
Greenhouse	33	62.3	0	0.0	1	1.9	19	35.8	53	100
Other	53	81.5	2	3.1	2	3.1	8	12.3	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 90.8% (260,944 acres) locate and grade farm access roads to minimize erosion potential.
- Growers representing 1.0% (2,851 acres) plan implementation within three years.
- Growers representing 1.3% (3,630 acres) do not plan to implement this practice..
- Growers representing 7.0% (20,108 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	260,944	90.8	2,851	1.0	3,630	1.3	20,108	7.0	287,533	100
Row Crop	169,569	92.9	2,006	1.1	1,985	1.1	8,963	4.9	182,523	100
Orchard	14,597	88.6	396	2.4	119	0.7	1,363	8.3	16,475	100
Vineyard	70,522	87.1	351	0.4	634	0.8	9,479	11.7	80,986	100
Nursery	884	88.4	2	0.2	28	2.8	86	8.6	1,000	100
Greenhouse	656	66.7	18	1.8	16	1.6	293	29.8	983	100
Other	14,465	95.6	226	1.5	36	0.2	406	2.7	15,133	100

E_4) Are farm access roads protected from concentrated runoff through the use of vegetative material, gravel, and/or mulch?

Responding Growers for all Crop Types

- 67.4% (701 growers) protect farm access roads from concentrated runoff through the use of vegetative material, gravel, and/or mulch.
- 7.5% (78 growers) plan implementation within three years.
- 8.9% (93 growers) do not plan to implement this practice.
- 16.2% (168 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	701	67.4	78	7.5	93	8.9	168	16.2	1,040	100
Row Crop	155	57.0	26	9.6	51	18.8	40	14.7	272	100
Orchard	168	65.9	21	8.2	18	7.1	48	18.8	255	100
Vineyard	224	77.8	15	5.2	13	4.5	36	12.5	288	100
Nursery	452	97.4	5	1.1	2	0.4	5	1.1	54	100
Greenhouse	28	52.8	3	5.7	2	3.8	20	37.7	53	100
Other	45	69.2	6	9.2	5	7.7	9	13.8	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 66.4% (190,907 acres) protect farm access roads from concentrated runoff through the use of vegetative material, gravel, and/or mulch.
- Growers representing 10.1% (28,906 acres) plan implementation within three years.
- Growers representing 13.3% (38,335 acres) do not plan to implement this practice.
- Growers representing 10.2% (29,385 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	190,907	66.4	28,906	10.1	38,335	13.3	29,385	10.2	287,533	100
Row Crop	110,261	60.4	21,261	11.6	34,714	19.0	16,287	8.9	182,523	100
Orchard	8,985	54.5	1,181	7.2	4,556	27.7	1,753	10.6	16,475	100
Vineyard	66,499	82.1	3,873	4.8	758	0.9	9,856	12.2	80,986	100
Nursery	838	83.8	63	6.3	25	2.5	74	7.4	1,000	100
Greenhouse	561	57.1	74	7.5	100	10.2	248	25.2	983	100
Other	12,592	83.2	1,736	11.5	289	1.9	516	3.4	15,133	100

E_5) Are ditches and channel banks protected from concentrated flow through the use of grassed waterways, lined channels, and/or diversions?

Responding Growers for all Crop Types

- 52.5% (546 growers) protect ditches and channel banks from concentrated flows through the use of grassed waterways and lined channels.
- 7.7% (80 growers) plan implementation within three years.
- 6.4% (67 growers) do not plan to implement this practice.
- 33.4% (347 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	546	52.5	80	7.7	67	6.4	347	33.4	1,040	100
Row Crop	149	54.8	34	12.5	40	14.7	49	18.0	272	100
Orchard	121	47.5	17	6.7	10	3.9	107	42.0	255	100
Vineyard	173	60.1	8	2.8	7	2.4	100	34.7	288	100
Nursery	24	44.4	9	16.7	4	7.4	17	31.5	54	100
Greenhouse	19	35.8	5	9.4	4	7.5	25	47.2	53	100
Other	33	50.8	5	7.7	1	1.5	26	40.0	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 57.6% (165,546 acres) protect ditches and channel banks from concentrated flows through the use of grassed waterways and lined channels.
- Growers representing 12.5% (35,950 acres) plan implementation within three years.
- Growers representing 14.9% (42,723 acres) do not plan to implement this practice.
- Growers representing 15.1% (43,314 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	165,546	57.6	35,950	12.5	42,723	14.9	43,314	15.1	287,533	100
Row Crop	92,462	50.7	24,534	13.4	43,310	23.7	22,217	12.2	182,523	100
Orchard	8,120	49.3	1,652	10.0	2,621	15.9	4,082	24.8	16,475	100
Vineyard	59,733	73.8	3,642	4.5	285	0.4	17,326	21.4	80,986	100
Nursery	377	37.7	208	20.8	45	4.5	370	37.0	1,000	100
Greenhouse	446	45.4	100	10.2	68	6.9	369	37.5	983	100
Other	8091	53.5	4,043	26.7	895	5.9	2,104	13.9	15,133	100

E_6) Are field layout and row length designed to minimize erosion potential?

Responding Growers for all Crop Types

- 72.7% (756 growers) design field layout and row length to minimize erosion potential.
- 1.3% (14 growers) plan implementation within three years.
- 3.7% (38 growers) do not plan to implement this practice.
- 22.3% (232 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	756	72.7	14	1.3	38	3.7	232	22.3	1,040	100
Row Crop	235	86.4	3	1.1	5	1.8	29	10.7	272	100
Orchard	176	69.0	6	2.4	8	3.1	65	25.5	255	100
Vineyard	220	76.4	2	0.7	19	6.6	47	16.3	288	100
Nursery	29	53.7	1	1.9	2	3.7	22	40.7	54	100
Greenhouse	15	28.3	2	3.8	0	0.0	36	67.9	53	100
Other	48	73.8	0	0.0	1	1.5	16	24.6	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 82.8% (237,955 acres) design field layout and row length to minimize erosion potential.
- Growers representing 1.0% (2,850 acres) plan implementation within three years.
- Growers representing 1.5% (4,440 acres) do not plan to implement this practice.
- Growers representing 14.7% (42,288 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	237,955	82.8	2,850	1.0	4,440	1.5	42,288	14.7	287,533	100
Row Crop	166,158	91.0	1,623	0.9	1,569	0.9	13,173	7.2	182,523	100
Orchard	12,148	73.7	155	0.9	438	2.7	3,734	22.7	16,475	100
Vineyard	53,734	66.3	1,120	1.4	2,187	2.7	23,945	29.6	80,986	100
Nursery	679	67.9	20	2.0	34	3.4	267	26.7	1,000	100
Greenhouse	463	47.1	17	1.7	10	1.0	493	50.2	983	100
Other	13,657	90.2	0	0.0	118	0.8	1,358	9.0	15,133	100

E_7) Are sediment basins constructed to intercept sediment-laden runoff in locations where erosion is expected and sediment is known to leave the farm?

Responding Growers for all Crop Types

- 38.8% (403 growers) construct sediment basins to intercept sediment-laden runoff in locations where erosion is expected.
- 6.7% (70 growers) plan implementation within three years.
- 8.4% (87 growers) do not plan to implement this practice.
- 46.2% (480 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	403	38.8	70	6.7	87	8.4	480	46.2	1,040	100
Row Crop	143	52.6	20	7.4	25	9.2	84	30.9	272	100
Orchard	77	30.2	21	8.2	25	9.8	132	51.8	255	100
Vineyard	106	36.8	11	3.8	25	8.7	146	50.7	288	100
Nursery	17	31.5	8	14.8	4	7.4	25	46.3	54	100
Greenhouse	14	26.4	5	9.4	2	3.8	32	60.4	53	100
Other	29	44.6	1	1.5	3	4.6	32	49.2	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 59.4% (170,694 acres) construct sediment basins to intercept sediment-laden runoff in locations where erosion is expected.
- Growers representing 3.9% (11,249 acres) plan implementation within three years.
- Growers representing 6.1% (17,635 acres) do not plan to implement this practice.
- Growers representing 30.6% (87,955 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	170,694	59.4	11,249	3.9	17,635	6.1	87,955	30.6	287,533	100
Row Crop	117,466	64.4	6,960	3.8	13,047	7.1	45,050	24.7	182,523	100
Orchard	7,378	44.8	1,949	11.8	1,668	10.1	5,480	33.3	16,475	100
Vineyard	35,996	44.4	1,642	2.0	3,962	4.9	39,386	48.6	80,986	100
Nursery	473	47.3	140	14.0	67	6.7	320	32.0	1,000	100
Greenhouse	404	41.1	56	5.7	106	10.8	417	42.4	983	100
Other	11,922	78.8	699	4.6	482	3.2	2,030	13.4	15,133	100

E_8) Are water and sediment control basins used in locations where sediment and excess runoff may cause gullies or flooding problems downstream?

Responding Growers for all Crop Types

- 34.2% (356 growers) use water and sediment control basins in locations where runoff may cause gullies or flooding downstream.
- 6.0% (62 growers) plan implementation within three years.
- 9.6% (100 growers) do not plan to implement this practice.
- 50.2% (522 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	356	34.2	62	6.0	100	9.6	522	50.2	1,040	100
Row Crop	125	46.0	15	5.5	27	9.9	105	38.6	272	100
Orchard	69	27.1	20	7.8	27	10.6	139	54.5	255	100
Vineyard	97	33.7	14	4.9	26	9.0	151	52.4	288	100
Nursery	14	25.9	7	13.0	4	7.4	29	53.7	54	100
Greenhouse	11	20.8	3	5.7	4	7.5	35	66.0	53	100
Other	22	33.8	1	1.5	8	12.3	34	52.3	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 52.8% (151,901 acres) use water and sediment control basins in locations where runoff may cause gullies or flooding downstream.
- Growers representing 4.4% (12,609 acres) plan implementation within three years.
- Growers representing 7.5% (21,481 acres) do plan to implement this practice.
- Growers representing 35.3% (101,542 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	151,901	52.8	12,609	4.4	21,481	7.5	101,542	35.3	287,533	100
Row Crop	97,058	53.2	8,872	4.9	13,566	7.4	63,027	34.5	182,523	100
Orchard	6,155	37.4	1,541	9.4	2,879	17.5	5,900	35.8	16,475	100
Vineyard	39,283	48.5	1,776	2.2	4,162	5.1	35,765	44.2	80,986	100
Nursery	378	37.8	108	10.8	64	6.4	450	45.0	1,000	100
Greenhouse	346	35.2	19	1.9	90	9.2	528	53.7	983	100
Other	9,543	63.1	505	3.3	2,254	14.9	2,831	18.7	15,133	100

E_9) Are vegetative buffers implemented between cropped areas, along the lower edge of the farm, and along roadways?

Responding Growers for all Crop Types

- 52.4% (545 growers) implement vegetative buffers between cropped areas, along the lower edge of the farm, and along roadways.
- 8.5% (88 growers) plan implementation within three years.
- 12.9% (134 growers) do not plan to implement this practice.
- 26.3% (273 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	545	52.4	88	8.5	134	12.9	273	26.3	1,040	100
Row Crop	123	45.2	33	12.1	65	23.9	51	18.8	272	100
Orchard	130	51.0	25	9.8	28	11.0	72	28.2	255	100
Vineyard	192	66.7	18	6.3	20	6.9	58	20.1	288	100
Nursery	24	44.4	5	9.3	6	11.1	19	35.2	54	100
Greenhouse	15	28.3	0	0.0	6	11.3	32	60.4	53	100
Other	31	47.7	5	7.7	7	10.8	22	33.8	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 41.9% (120,405 acres) implement vegetative buffers between cropped areas, along the lower edge of the farm, and along roadways.
- Growers representing 13.4% (38,461 acres) plan implementation within three years.
- Growers representing 24.2% (67,710 acres) do not plan to implement this practice.
- Growers representing 20.5% (58,957 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	120,405	41.9	38,461	13.4	69,710	24.2	58,957	20.5	287,533	100
Row Crop	56,920	31.2	24,338	13.3	63,202	34.6	38,063	20.9	182,523	100
Orchard	8,362	50.8	3,161	19.2	2,637	16.0	2,315	14.1	16,475	100
Vineyard	45,383	56.0	11,109	13.7	6,677	8.2	17,817	22.0	80,986	100
Nursery	525	52.5	49	4.9	86	8.6	340	34.0	1,000	100
Greenhouse	258	26.2	23	2.3	141	14.3	561	57.1	983	100
Other	10,064	66.5	389	2.6	3,110	20.6	1,570	10.4	15,133	100

E_10) Where streams cross or border property, are riparian buffers established and maintained?

Responding Growers for all Crop Types

- 38.9% (405 growers) established and maintain riparian buffers where streams cross or border property.
- 3.6% (37 growers) plan implementation within three years.
- 4.5% (47 growers) do not plan to implement this practice.
- 53.0% (551 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	405	38.9	37	3.6	47	4.5	551	53.0	1,040	100
Row Crop	113	41.5	13	4.8	17	6.3	129	47.4	272	100
Orchard	103	40.4	11	4.3	11	4.3	130	51.0	255	100
Vineyard	118	41.0	4	1.4	10	3.5	156	54.2	288	100
Nursery	16	29.6	2	3.7	2	3.7	34	63.0	54	100
Greenhouse	11	20.8	2	3.8	4	7.5	36	67.9	53	100
Other	26	40.0	4	6.2	2	3.1	33	50.8	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 45.1% (129,769 acres) established and maintain riparian buffers where streams cross or border property.
- Growers representing 3.3% (9,480 acres) plan implementation within three years.
- Growers representing 6.8% (19,482 acres) do not plan to implement this practice.
- Growers representing 44.8% (128,802 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	129,769	45.1	9,480	3.3	19,482	6.8	128,802	44.8	287,533	100
Row Crop	89,435	49.0	1,987	1.1	14,852	8.1	76,249	41.8	182,523	100
Orchard	9,428	57.2	630	3.8	1,781	10.8	4,636	28.1	16,475	100
Vineyard	27,126	33.5	6,621	8.2	1,805	2.2	45,434	56.1	80,986	100
Nursery	522	52.2	21	2.1	26	2.6	431	43.1	1,000	100
Greenhouse	168	17.1	56	5.7	20	2.0	739	75.2	983	100
Other	6,998	46.2	412	2.7	649	4.3	7,074	46.7	15,133	100

E_11) Are culverts properly sized and maintained?

Responding Growers for all Crop Types

- 59.6% (620 growers) properly size and maintain culverts.
- 2.5% (26 growers) plan implementation within three years.
- 1.1% (11 growers) do not plan to implement this practice.
- 36.8% (383 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	620	59.6	26	2.5	11	1.1	383	36.8	1,040	100
Row Crop	194	71.3	7	2.6	2	0.7	69	25.4	272	100
Orchard	132	51.8	7	2.7	4	1.6	112	43.9	255	100
Vineyard	177	61.5	2	0.7	2	0.7	107	37.2	288	100
Nursery	30	55.6	4	7.4	1	1.9	19	35.2	54	100
Greenhouse	21	39.6	2	3.8	2	3.8	28	52.8	53	100
Other	38	58.5	3	4.6	0	0.0	24	36.9	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 78.5% (225,636 acres) properly size and maintain culverts.
- Growers representing 1.2% (3,561 acres) plan implementation within three years.
- Growers representing 0.1% (386 acres) do not plan to implement this practice.
- Growers representing 20.2% (57,950 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	225,636	78.5	3,561	1.2	386	0.1	57,950	20.2	287,533	100
Row Crop	147,652	80.9	2,740	1.5	87	0.05	32,044	17.6	182,523	100
Orchard	11,855	72.0	177	1.1	55	0.3	4,388	26.6	16,475	100
Vineyard	59,519	73.5	35	0.04	204	0.3	21,228	26.2	80,986	100
Nursery	773	77.3	50	5.0	24	2.4	153	15.3	1,000	100
Greenhouse	534	54.3	25	2.5	16	1.6	408	41.5	983	100
Other	12,304	81.3	453	3.0	0	0.0	2,376	15.7	15,133	100

E_12) Are implemented management practices evaluated for effectiveness (i.e. photo-point monitoring, water quality testing)?

Responding Growers for all Crop Types

- 38.4% (399 growers) evaluate implemented management practices for effectiveness.
- 20.2% (210 growers) plan implementation within three years.
- 19.5% (203 growers) do not plan to implement this practice.
- 21.9% (228 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	399	38.4	210	20.2	203	19.5	228	21.9	1,040	100
Row Crop	130	47.8	60	22.1	46	16.9	36	13.2	272	100
Orchard	78	30.6	56	22.0	57	22.4	64	25.1	255	100
Vineyard	111	38.5	59	20.5	51	17.7	67	23.3	288	100
Nursery	20	37.0	11	20.4	12	22.2	11	20.4	54	100
Greenhouse	18	34.0	4	7.5	13	24.5	18	34.0	53	100
Other	20	30.8	12	18.5	13	20.0	20	30.8	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 60.8% (174,835 acres) evaluate implemented management practices for effectiveness.
- Growers representing 17.1% (49,256 acres) plan implementation within three years.
- Growers representing 9.6% (27,535 acres) do not plan to implement this practice.
- Growers representing 12.5% (35,907 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	174,835	60.8	49,256	17.1	27,535	9.6	35,907	12.5	287,533	100
Row Crop	119,784	65.6	30,234	16.6	9,733	5.3	22,772	12.5	182,523	100
Orchard	6,556	39.8	3,833	23.3	2,756	16.7	3,330	20.2	16,475	100
Vineyard	42,025	51.9	14,801	18.3	12,574	15.5	11,586	14.3	80,986	100
Nursery	451	45.1	310	31.0	138	13.8	101	10.1	1,000	100
Greenhouse	388	39.5	112	11.4	192	19.5	291	29.6	983	100
Other	9,436	62.4	1,831	12.1	1,702	11.2	2,164	14.3	15,133	100

Nutrient Management

The questions for this section are listed below. The responses for all crop types to the individual questions follow in the summary graphs (refer to Figures 8 and 9). The responses by growers to each nutrient management question are outlined by major crop type along with the represented acreage.

<u>Nutrient Management Questions</u>

N_1) Are the crop's nutrient requirements known and are nutrient budgets established and recorded?

N_2) Do you test irrigation water for nitrogen content and incorporate that information into your fertilization program?

N_3) Is plant tissue analysis used to aid in fertilizer decisions?

N_4) Do you test your soil for residual nitrogen and incorporate that information into your fertilization program?

N_5) If fertigation is used, are measures in place to ensure that there is no backflow into wells or other water sources?

N_6) Do you regularly maintain and calibrate your fertilizer equipment?

N_7) Do field personnel receive nutrient management training?

N_8) Do fertilizer storage facilities include concrete pads and curbs for containment of spills and are they protected from weather?

N_9) Is mixing and loading performed on sites with low runoff hazard, over 100' down slope of wells?

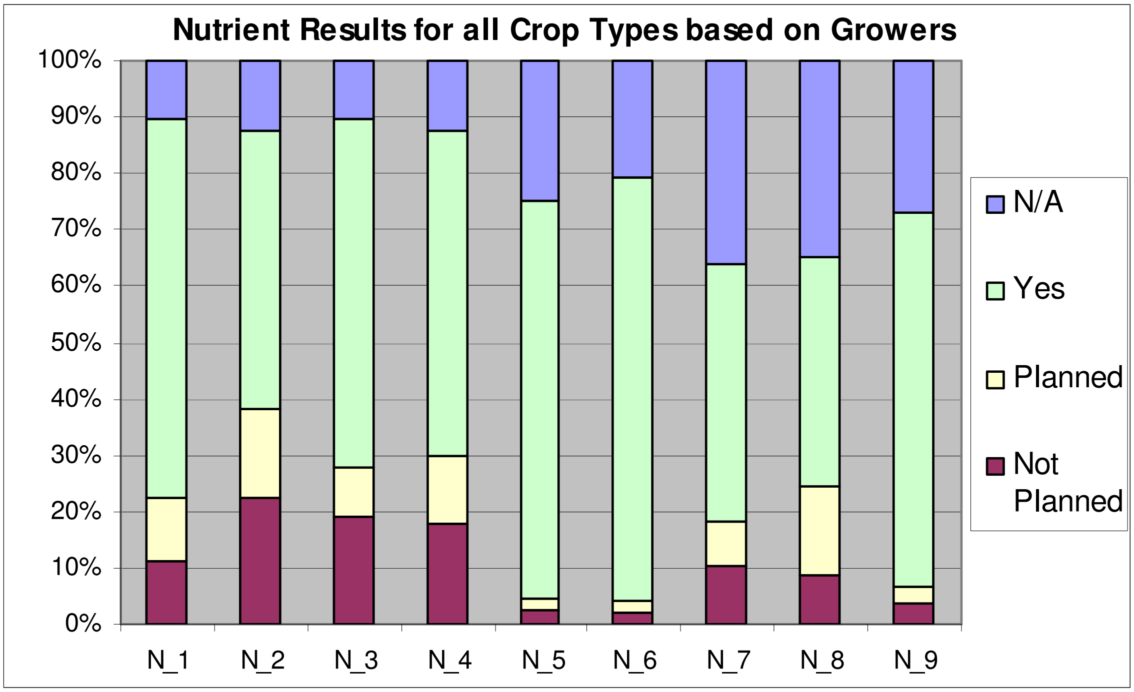

Figure 8: Level of implementation of nutrient management practices for all represented growers.

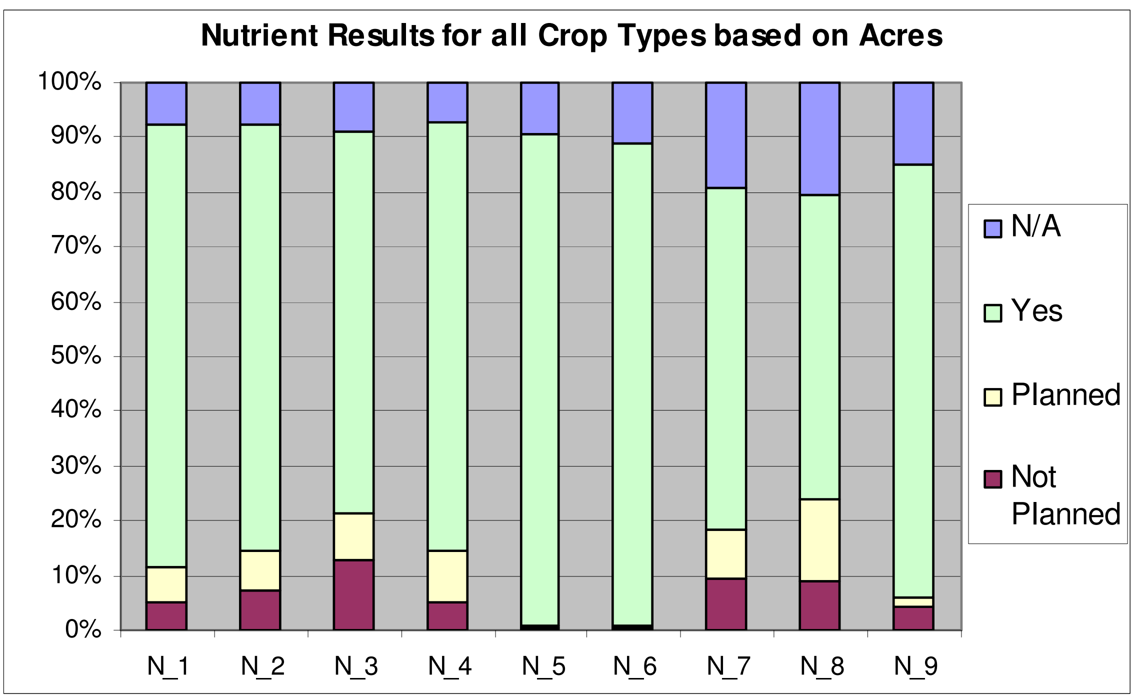

Figure 9: Level of implementation of nutrient management practices for all represented acres.

N_1) Are the crop's nutrient requirements known and are nutrient budgets established and recorded?

Responding Growers for all Crop Types

- 67.4% (701 growers) know crop nutrient requirements and nutrient budgets are established and recorded.
- 11.2% (116 growers) plan implementation within three years.
- 11.2% (116 growers) do not plan to implement this practice.
- 10.3% (107 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	701	67.4	116	11.2	116	11.2	107	10.3	1,040	100
Row Crop	191	70.2	31	11.4	29	10.7	21	7.7	272	100
Orchard	168	65.9	29	11.4	32	12.5	26	10.2	255	100
Vineyard	220	76.4	26	9.0	13	4.5	29	10.1	288	100
Nursery	32	59.3	5	9.3	12	22.2	5	9.3	54	100
Greenhouse	27	50.9	5	9.4	9	17.0	12	22.6	53	100
Other	33	50.8	13	20.0	12	18.5	7	10.8	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 80.9% (232,540 acres) know crop nutrient requirements and nutrient budgets are established and recorded.
- Growers representing 6.5% (18,579 acres) plan implementation within three years.
- Growers representing 5.0% (14,307 acres) do not plan to implement this practice.
- Growers representing 7.7% (22,107 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	232,540	80.9	18,579	6.5	14,307	5.0	22,107	7.7	287,533	100
Row Crop	145,157	79.5	14,450	7.9	11,974	6.6	10,942	6.0	182,523	100
Orchard	13,581	82.4	846	5.1	1,424	8.6	624	3.8	16,475	100
Vineyard	68,268	84.3	2,731	3.4	414	0.5	9,573	11.8	80,986	100
Nursery	741	74.1	76	7.6	153	15.3	30	3.0	1,000	100
Greenhouse	665	67.7	45	4.6	88	9.0	185	18.8	983	100
Other	11,431	75.5	2,163	14.3	645	4.3	894	5.9	15,133	100

N_2) Do you test irrigation water for nitrogen content and incorporate that information into your fertilization program?

Responding Growers for all Crop Types

- 49.3% (513 growers) test irrigation water for nitrogen content and information is incorporated into fertilization program.
- 6.0% (166 growers) plan implementation within three years.
- 22.3% (232 growers) do not plan to implement this practice.
- 12.4% (129 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	513	49.3	166	16.0	232	22.3	129	12.4	1,040	100
Row Crop	166	61.0	40	14.7	40	14.7	26	9.6	272	100
Orchard	99	38.8	52	20.4	69	27.1	35	13.7	255	100
Vineyard	146	50.7	43	14.9	69	24.0	30	10.4	288	100
Nursery	25	46.3	5	9.3	14	25.9	10	18.5	54	100
Greenhouse	28	52.8	4	7.5	8	15.1	13	24.5	53	100
Other	22	33.8	15	23.1	19	29.2	9	13.8	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 78.1% (224,550 acres) test irrigation water for nitrogen content and information is incorporated into fertilization program.
- Growers representing 7.3% (21,058 acres) plan implementation within three years.
- Growers representing 7.1% (20,406 acres) do not plan to implement this practice.
- Growers representing 7.5% (21,519 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	224,550	78.1	21,058	7.3	20,406	7.1	21,519	7.5	287,533	100
Row Crop	147,227	80.7	11,615	6.4	13,789	7.6	9,892	5.4	182,523	100
Orchard	9,978	60.6	2,903	17.6	1,885	11.4	1,709	10.4	16,475	100
Vineyard	61,248	75.6	6,009	7.4	4,138	5.1	9,591	11.8	80,986	100
Nursery	615	61.5	219	21.9	105	10.5	61	6.1	1,000	100
Greenhouse	614	62.5	42	4.3	92	9.4	235	23.9	983	100
Other	11,992	79.2	1,205	8.0	1,101	7.3	835	5.5	15,133	100

N_3) Is plant tissue analysis used to aid in fertilizer decisions?

Responding Growers for all Crop Types

- 62.0% (645 growers) use plant tissue analysis to aid in fertilizer decisions.
- 8.8% (92 growers) plan implementation within three years.
- 18.9% (197 growers) do not plan to implement this practice.
- 10.2% (106 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	645	62.0	92	8.8	197	18.9	106	10.2	1,040	100
Row Crop	145	53.3	34	12.5	69	25.4	24	8.8	272	100
Orchard	167	65.5	24	9.4	40	15.7	24	9.4	255	100
Vineyard	237	82.3	14	4.9	11	3.8	26	9.0	288	100
Nursery	17	31.5	4	7.4	25	46.3	8	14.8	54	100
Greenhouse	24	45.3	3	5.7	14	26.4	12	22.6	53	100
Other	24	36.9	11	16.9	23	35.4	7	10.8	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 69.3% (119,183 acres) use plant tissue analysis to aid in fertilizer decisions.
- Growers representing 8.7% (25,114 acres) plan implementation within three years.
- Growers representing 12.8% (36,930 acres) do not plan to implement this practice.
- Growers representing 9.1% (26,306 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	199,183	69.3	25,114	8.7	36,930	12.8	26,306	9.1	287,533	100
Row Crop	111,263	61.0	18,902	10.4	36,664	20.1	15,694	8.6	182,523	100
Orchard	13,639	82.8	1,099	6.7	1,033	6.3	704	4.3	16,475	100
Vineyard	70,858	87.5	208	0.3	398	0.5	9,522	11.8	80,986	100
Nursery	638	63.8	91	9.1	206	20.6	65	6.5	1,000	100
Greenhouse	597	60.7	36	3.7	144	14.6	206	21.0	983	100
Other	7,239	47.8	5,012	33.1	2,303	15.2	579	3.8	15,133	100

N_4) Do you test your soil for residual nitrogen and incorporate that information into your fertilization program?

Responding Growers for all Crop Types

- 57.8% (601 growers) test soil for residual nitrogen and information is incorporated into fertilization program.
- 12.1% (126 growers) plan implementation within three years.
- 17.7% (184 growers) do not plan to implement this practice.
- 12.4% (129 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	601	57.8	126	12.1	184	17.7	129	12.4	1,040	100
Row Crop	191	70.2	29	10.7	29	10.7	23	8.5	272	100
Orchard	129	50.6	41	16.1	58	22.7	27	10.6	255	100
Vineyard	171	59.4	41	14.2	43	14.9	33	11.5	288	100
Nursery	24	44.4	1	1.9	13	24.1	16	29.6	54	100
Greenhouse	23	43.4	5	9.4	9	17.0	16	30.2	53	100
Other	33	50.8	7	10.8	19	29.2	6	9.2	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 78.2% (224,829 acres) test soil for residual nitrogen and information is incorporated into fertilization program.
- Growers representing 9.3% (26,683 acres) plan implementation within three years.
- Growers representing 5.2% (14,841 acres) do not plan to implement this practice.
- Growers representing 7.4% (21,180 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	224,829	78.2	26,683	9.3	14,841	5.2	21,180	7.4	287,533	100
Row Crop	152,883	83.8	10,010	5.5	11,362	6.2	8,268	4.5	182,523	100
Orchard	10,773	65.4	3,441	20.9	1,440	8.7	821	5.0	16,475	100
Vineyard	56,394	69.6	11,860	14.6	1,416	1.7	11,316	14.0	80,986	100
Nursery	430	43.0	64	6.4	126	12.6	380	38.0	1,000	100
Greenhouse	520	52.9	35	3.6	97	9.9	331	33.7	983	100
Other	12,553	83.0	887	5.9	1,152	7.6	541	3.6	15,133	100

N_5) If fertigation is used, are measures in place to ensure that there is no backflow into wells or other water sources?

Responding Growers for all Crop Types

- 70.7% (735 growers) have measures in place to ensure that there is no backflow into water sources, if fertigation is used.
- 2.2% (23 growers) plan implementation within three years.
- 2.3% (24 growers) do not plan to implement this practice.
- 24.8% (258 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	735	70.7	23	2.2	24	2.3	258	24.8	1,040	100
Row Crop	227	83.5	6	2.2	6	2.2	33	12.1	272	100
Orchard	151	59.2	7	2.7	8	3.1	89	34.9	255	100
Vineyard	226	78.5	3	1.0	3	1.0	56	19.4	288	100
Nursery	29	53.7	1	1.9	1	1.9	23	42.6	54	100
Greenhouse	32	60.4	2	3.8	1	1.9	18	34.0	53	100
Other	35	53.8	1	1.5	3	4.6	26	40.0	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 89.6% (257,608 acres) have measures in place to ensure that there is no backflow into water sources, if fertigation is used.
- Growers representing 0.4% (1,229 acres) plan implementation within three years.
- Growers representing 0.4% (1,273 acres) do not plan to implement this practice.
- Growers representing 9.5% (27,423 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	257,608	89.6	1,229	0.4	1,273	0.4	27,423	9.5	287,533	100
Row Crop	169,798	93.0	1,118	0.6	458	0.3	11,149	6.1	182,523	100
Orchard	12,388	75.2	133	0.8	576	3.5	3,378	20.5	16,475	100
Vineyard	70,178	86.7	87	0.1	202	0.2	10,519	13.0	80,986	100
Nursery	721	72.1	5	0.5	24	2.4	250	25.0	1,000	100
Greenhouse	624	63.5	5	0.5	17	1.7	337	34.3	983	100
Other	11,948	78.9	10	0.07	351	2.3	2,824	18.7	15,133	100

N_6) Do you regularly maintain and calibrate your fertilizer equipment?

Responding Growers for all Crop Types

- 74.9% (779 growers) regularly calibrate and maintain fertilizer equipment.
- 2.3% (24 growers) plan implementation within three years.
- 1.9% (20 growers) do not plan to implement this practice.
- 20.9% (217 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	779	74.9	24	2.3	20	1.9	217	20.9	1,040	100
Row Crop	219	80.5	5	1.8	3	1.1	45	16.5	272	100
Orchard	173	67.8	5	2.0	8	3.1	69	27.1	255	100
Vineyard	226	78.5	7	2.4	1	0.3	54	18.8	288	100
Nursery	41	75.9	1	1.9	1	1.9	11	20.4	54	100
Greenhouse	37	69.8	3	5.7	1	1.9	12	22.6	53	100
Other	45	69.2	3	4.6	3	4.6	14	21.5	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 88.0% (253,010 acres) regularly calibrate and maintain fertilizer equipment.
- Growers representing 0.4% (1,033 acres) plan implementation within three years.
- Growers representing 0.4% (1,155 acres) do not plan to implement this practice.
- Growers representing 11.2% (32,335 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	253,010	88.0	1,033	0.4	1,155	0.4	32,335	11.2	287,533	100
Row Crop	161,439	88.4	512	0.3	790	0.4	19,782	10.8	182,523	100
Orchard	14,434	87.6	164	1.0	305	1.9	1,572	9.5	16,475	100
Vineyard	70,433	87.0	97	0.1	13	0.0	10,443	12.9	80,986	100
Nursery	932	93.2	1	0.1	9	0.9	58	5.8	1,000	100
Greenhouse	787	80.1	12	1.2	16	1.6	168	17.1	983	100
Other	13,149	86.9	455	3.0	23	0.2	1,506	10.0	15,133	100

N_7) Do field personnel receive nutrient management training?

Responding Growers for all Crop Types

- 45.6% (474 growers) have field personnel who received nutrient management training.
- 8.1% (84 growers) plan implementation within three years.
- 10.2% (106 growers) do not plan on implementing this practice.
- 36.2% (376 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	474	45.6	84	8.1	106	10.2	376	36.2	1,040	100
Row Crop	146	53.7	31	11.4	33	12.1	62	22.8	272	100
Orchard	98	38.4	16	6.3	19	7.5	122	47.8	255	100
Vineyard	140	48.6	19	6.6	19	6.6	110	38.2	288	100
Nursery	23	42.6	4	7.4	12	22.2	15	27.8	54	100
Greenhouse	22	41.5	4	7.6	7	13.2	20	37.7	53	100
Other	19	29.2	9	13.8	11	16.9	26	40.0	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 62.6% (179,901 acres) have field personnel who received nutrient management training.
- Growers representing 8.7% (24,886 acres) plan implementation within three years.
- Growers representing 9.6% (27,659 acres) do not plan to implement this practice.
- Growers representing 19.2% (55,087 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	179,901	62.6	24,886	8.7	27,659	9.6	55,087	19.2	287,533	100
Row Crop	122,853	67.3	9,873	5.4	17,768	9.7	32,029	17.5	182,523	100
Orchard	10,529	63.9	1,518	9.2	1,194	7.2	3,234	19.6	16,475	100
Vineyard	42,452	52.4	9095	11.2	7,011	8.7	22,428	27.7	80,986	100
Nursery	577	57.7	26	2.6	308	30.8	89	8.9	1,000	100
Greenhouse	542	55.1	66	6.7	102	10.4	273	27.8	983	100
Other	5,895	39.0	4161	27.5	2,658	17.6	2,419	16.0	15,133	100

N_8) Do fertilizer storage facilities include concrete pads and curbs for containment of spills and are they protected from weather?

Responding Growers for all Crop Types

- 40.8% (424 growers) have fertilizer storage facilities that include concrete pads and curbs for containment of spills and protection from weather.
- 15.6% (162 growers) plan implementation within three years.
- 8.7% (90 growers) do not plan to implement this practice.
- 35.0% (364 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	424	40.8	162	15.6	90	8.7	364	35.0	1,040	100
Row Crop	119	43.8	40	14.7	25	9.2	88	32.4	272	100
Orchard	91	35.7	43	16.9	31	12.2	90	35.3	255	100
Vineyard	104	36.1	44	15.3	20	6.9	120	41.7	288	100
Nursery	33	61.1	5	9.3	4	7.4	12	22.2	54	100
Greenhouse	31	58.5	10	18.9	1	1.9	11	20.8	53	100
Other	23	35.4	10	15.4	7	10.8	25	38.5	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 55.4% (159,229 acres) have fertilizer storage facilities that include concrete pads and curbs for containment of spills and protection from weather.
- Growers representing 14.9% (42,901 acres) plan implementation within three years.
- Growers representing 9.0% (25,968 acres) do not plan to implement this practice.
- Growers representing 20.7% (59,435 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	159,229	55.4	42,901	14.9	25,968	9.0	59,435	20.7	287,533	100
Row Crop	113,702	62.3	24,387	13.4	11,280	6.2	33,154	18.2	182,523	100
Orchard	6,487	39.4	3,490	21.2	1,908	11.6	4,590	27.9	16,475	100
Vineyard	34,075	42.1	13,075	16.1	14,177	17.5	19,659	24.3	80,986	100
Nursery	615	61.5	127	12.7	42	4.2	216	21.6	1,000	100
Greenhouse	462	47.0	270	27.5	72	7.3	179	18.2	983	100
Other	8,971	59.3	2,079	13.7	1,635	10.8	2,448	16.2	15,133	100

N_9) Is mixing and loading performed on sites with low runoff hazard, over 100' downslope of wells?

Responding Growers for all Crop Types

- 66.2% (688 growers) perform mixing and loading on sites with low runoff hazard, over 100' downslope of wells.
- 3.0% (31 growers) plan implementation within three years.
- 3.8% (39 growers) do not plan to implement this practice.
- 27.1% (282 growers) replied N/A.

Responding Growers	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Responses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	688	66.2	31	3.0	39	3.8	282	27.1	1,040	100
Row Crop	197	72.4	9	3.3	14	5.1	52	19.1	272	100
Orchard	145	56.9	9	3.5	7	2.7	94	36.9	255	100
Vineyard	202	70.1	7	2.4	8	2.8	71	24.7	288	100
Nursery	35	64.8	0	0.0	3	5.6	16	29.6	54	100
Greenhouse	28	52.8	3	5.7	4	7.5	18	34.0	53	100
Other	42	64.6	3	4.6	1	1.5	19	29.2	65	100

Represented Irrigated Acreage for all Crop Types

- Growers representing 79.1% (227,353 acres) perform mixing and loading on sites with low runoff hazard, over 100' down slope of wells.
- Growers representing 1.4% (4,035 acres) plan implementation within three years.
- Growers representing 4.4% (12,615 acres) do not plan to implement this practice.
- Growers representing 15.1% (43,530 acres) replied N/A.

Represented Acres	Level of Implementation									
	Yes, implemented		No, but planned in 3 years		No, and not planned		Not applicable		Total Acres	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Crop Types	227,353	79.1	4,035	1.4	12,615	4.4	43,530	15.1	287,533	100
Row Crop	154,679	84.7	795	0.4	5,941	3.3	21,108	11.6	182,523	100
Orchard	11,659	70.8	1,146	7.0	324	2.0	3,346	20.3	16,475	100
Vineyard	55,932	69.1	1,561	1.9	5,646	7.0	17,847	22.0	80,986	100
Nursery	701	70.1	0	0.0	43	4.3	256	25.6	1,000	100
Greenhouse	639	65.0	100	10.2	32	3.3	212	21.6	983	100
Other	13,027	86.1	300	2.0	35	0.2	1,771	11.7	15,133	100

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Central Coast Water Board

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Central Coast
Water Board

Exhibit 9

Appendix F

Staff Recommendations for Agricultural Order

TECHNICAL MEMORANDUM:

Cost Considerations Concerning Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands

CENTRAL COAST REGIONAL WATER QUALITY CONTROL BOARD

March 2011

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TABLE OF CONTENTS

TABLE OF TABLES

1 INTRODUCTION

On July 9, 2004, the Central Coast Regional Water Quality Control Board (Central Coast Water Board) adopted a ***Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands*** (2004 Conditional Waiver). Since the adoption of the 2004 Conditional Waiver, the Central Coast Water Board has documented that discharges of waste from irrigated lands, including nutrients, toxic compounds, and other constituents found in fertilizers, pesticides, and sediment, continue to degrade water quality and impair beneficial uses. Activities that have resulted in the discharges of waste that degrade water quality and impair beneficial uses include farm management practices and removal and degradation of riparian and wetland habitat. The 2004 Conditional Waiver expired on July 9, 2009 and has been renewed without revisions until March 2011. The Central Coast Water Board will consider renewing the 2004 Conditional Waiver prior to the expiration of the 2004 Conditional Waiver.

Central Coast Water Board staff prepared this Technical Memorandum to present cost considerations concerning the proposed renewal of the Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands (Draft Agricultural Order No. R3-2011-0006 (Draft Ag Order)). The goal of this cost analysis is to present the full range of costs associated with the Draft Ag Order and to address concerns raised at Public Workshops held during the spring and summer of 2010.

The Central Coast Water Board is not generally required to consider costs when it adopts a waiver of waste discharge requirements pursuant to Water Code section 13269. Water Code section 13269 requires the Water Board to impose conditions on any waiver and the waiver must be consistent with the applicable water quality control plan (Basin Plan). Water Code section 13141 requires regional water boards to estimate the total costs of any agricultural water quality control program and an identification of potential sources of financing when a Regional Water Board amends a Basin Plan. The Draft Ag Order is not proposed to be included in the Basin Plan; however, this cost analysis provides the information that would be required by Water Code section 13141. The Central Coast Water Board is not required to consider economic or social impacts under the California Environmental Quality Act (CEQA) except where such impacts result in actual physical adverse impacts on the environment caused by the project. This cost analysis provides information that is used in the CEQA document to be considered by the Central Coast Water Board. The Central Coast Water Board is not required to perform a formal cost/benefit analysis when issuing waste discharge requirements or a waiver of waste discharge requirements or when complying with CEQA.

2 COSTS OF IMPLEMENTATION

2.1 Introduction

Growers, farmland owners, and the Central Coast Water Board, as the administering entity, would potentially incur the direct costs of implementing the Draft Ag Order. Staff compiled information available from various sources to characterize the type and approximate scale of these costs.

2.2 Cost Of Compliance to Growers and Farmland Owners

2.2.1 Management Practice Implementation, Monitoring and Reporting

The Draft Ag Order includes specific conditions requiring irrigated agricultural dischargers to implement management practices and conduct monitoring and reporting. The Draft Ag Order does not generally specify the manner of compliance – many different management practices could be implemented to comply with the conditions of the Draft Ag Order to attain water quality standards in the receiving waters. This portion of this Memorandum includes an estimate of costs of implementation of possible management practices that growers could use to comply. These requirements, summarized in Table 1, have the potential to increase costs to growers and agricultural land owners, depending on current level of compliance and other factors.

The Draft Ag Order requires dischargers to comply with conditions for the “tier” that applies to their operation. The tiers are based on criteria that indicate operations that have a low, moderate or high level of waste discharge, or a low, moderate or high threat or contribution to water quality degradation. Tier 1, lowest threat, dischargers have the fewest requirements (including implementation, monitoring and reporting) and Tier 3, highest threat, dischargers have the most requirements. Therefore, Tier 3 dischargers will most likely incur higher costs than Tier 1 or Tier 2 dischargers and a greater increase in costs compared to the cost of complying with the 2004 Conditional Waiver. For all dischargers, most of the costs to comply with the Draft Ag Order will be for implementation of management practices. Remaining additional costs will be for monitoring and reporting.

For example, the proposed draft 2011 Agricultural Order proposes the following implementation and reporting requirements:

- Implement pesticide management practices to reduce toxicity in discharges so receiving waterbodies meet water quality standards;
- Implement nutrient management practices to eliminate or minimize nutrient and salt in discharges to surface water so receiving waterbodies meet water quality standards;
- Implement nutrient management practices to minimize fertilizer and nitrate loading to groundwater to meet nitrate loading targets ;

- Install and properly maintain back flow prevention devices for wells or pumps that apply fertilizers, pesticides, fumigants or other chemicals through an irrigation system;
- Implement erosion control and sediment management practices to reduce sediment in discharges so receiving water bodies meet water quality standards;
- Protect and manage existing aquatic habitat to prevent discharge of waste to waters of the State and protect the beneficial uses of these waters;
- Implement stormwater runoff and quality management practices.
- Develop, implement, and annually-update Farm Water Quality Management Plans.
- Submit an Annual Compliance Document (for higher threat dischargers) that includes individual discharge monitoring results, nitrate loading potential evaluation and, if nitrate loading potential is high, irrigation and nutrient management plan, verification of irrigation and nutrient management plan effectiveness.
- Submit a water quality buffer plan (for higher threat dischargers), if operations contain or are adjacent to a waterbody identified on the Clean Water Act Section 303(d) List of Impaired Waterbodies as impaired for temperature or turbidity.

Staff developed this Draft Order to address the documented severe and widespread water quality problems in the Central Coast Region, predominately unsafe levels of nitrate in ground water used for drinking water and toxicity impairing communities of aquatic organisms.

This proposed draft 2011 Agricultural Order requires dischargers to implement practices or operational changes to reduce pollutant loading to waters of the State in the Central Coast Region. The proposed draft 2011 Agricultural Order requires more specific and measurable tracking and evaluation of effectiveness of practices and more comprehensive water quality monitoring (e.g., individual discharges and groundwater) than the 2004 Conditional Waiver.

Table 1: Requirements in Draft Ag Order with Potential to Increase Costs to Dischargers

CONDITIONS	**Due in:[1]**
Pesticide Runoff/Toxicity Elimination	
All dischargers must implement management practices to eliminate or minimize toxicity and pesticide discharges so receiving water bodies meet water quality standards	immediately
Nutrient and Salt Management	
All dischargers must implement nutrient management practices to minimize nutrient and salt discharges so receiving water bodies meet water quality standards	immediately
All dischargers must minimize nutrient discharges from fertilizer and nitrate loading to groundwater so receiving water bodies meet water quality standards and safe drinking water is protected	immediately
Tier 3 dischargers must evaluate the nitrate loading potential factor (as high, medium or low) of their operations, annually	1 Yr
Tier 3 dischargers ***with a high nitrate loading potential*** must develop and initiate implementation of a certified Irrigation and Nutrient Management Plan (INMP) to meet specified nitrogen balance ratio targets	2 Yrs
Sediment Management / Erosion Control / Stormwater Management	
All dischargers must implement erosion control and sediment management practices to eliminate or minimize the discharge of sediments and turbidity so receiving water bodies meet water quality standards	3 Yrs
All dischargers must protect existing aquatic habitat (including perennial, intermittent, or ephemeral streams, lakes, and riparian and wetland area habitat or other waterbodies) to prevent discharges of waste so receiving water bodies meet water quality standards.	immediately
All dischargers must implement stormwater management practices to minimize stormwater runoff	immediately
Tier 2 and Tier 3 Dischargers must evaluate conditions of riparian and wetland habitat areas ***if their operations contain or are adjacent to a waterbody identified on the Clean Water Act Section 303(Dd) List of Impaired Waterbodies as impaired for temperature or turbidity.***	1 Yr
Tier 3 dischargers must develop and initiate implementation of a Water Quality Buffer Plan to prevent waste discharge or water quality degradation, ***if their operations contain or are adjacent to a waterbody identified on the Clean Water Act Section 303(d) List of Impaired Waterbodies as impaired for sediment, temperature or turbidity and the discharger's runoff drains to that waterbody.*** The plan must include the following or the functional equivalent: minimum of 30 foot buffer; wider buffer if necessary to prevent discharge of waste; three zones with distinct types of vegetation (moving from area closest to waterbody to areas away from waterbody) to jointly provide shade, pollutant treatment through infiltration and reduced velocity of flow to promote sediment deposition; schedule for implementation; and maintenance provisions.	4 Yrs
General Groundwater Protection Requirements	
All dischargers that apply fertilizers, pesticides, fumigants or other chemicals through an irrigation system must have functional and properly maintained back flow prevention devices installed at the well or pump to prevent contamination of groundwater or surface water.	3 Yrs
All dischargers must properly destroy all abandoned groundwater wells, exploration holes or test holes, in such a manner that they will not produce water or act as a conduit for mixing or otherwise transfer groundwater or waste constituents between permeable	NA

[1] Where specified time periods/deadlines are included in the proposed Order. NA = no time period specified in order.

zones or aquifers.	
All dischargers who choose to utilize containment structures (such as retention ponds or reservoirs) to achieve treatment or control of the discharge of wastes, must construct and maintain such containment structures to avoid percolation of waste to groundwater that causes or contributes to exceedancess of water quality standards and to avoid surface water overflows that have the potential to impair water quality	NA
MONITORING	
All dischargers must sample private domestic and agricultural supply groundwater wells located at their operation, twice in one year	2Yrs
All dischargers must conduct watershed-scale (receiving water) monitoring as part of cooperative group or individually, monthly for five years	6 Months
Tier 2 and Tier 3 dischargers must photo-document existing conditions of riparian and wetland habitat areas, one time in five years, ***if their operation(s) contain or are adjacent to a waterbody identified on the Clean Water Act Section 303(d) List of Impaired Waterbodies as impaired for sediment, temperature or turbidity.***	1 Yr
Tier 3 dischargers must conduct individual discharge monitoring, two to four times per year for five years	6 months
REPORTING	
All dischargers must submit Notice of Intent to Enroll	60 days
All dischargers must submit results of groundwater sampling and related well information	6 Months
Tier 2 and 3 dischargers must submit an Annual Compliance Document that includes status information on implementation of required conditions (e.g. implementation of management practices) and results of any required sampling or monitoring, appropriate for the tier applicable to the discharger's operation.	2 Yrs
Tier 2 and Tier 3 dischargers must submit photo-documentation of conditions of riparian and wetland habitat areas with the Annual Compliance Document, ***if their operation(s) contain or are adjacent to a waterbody identified on the Clean Water Act Section 303(d) List of Impaired Waterbodies as impaired for sediment, temperature or turbidity.***	1 yr
Tier 3 dischargers must submit results of individual discharge monitoring	2 Yrs
Tier 3 dischargers must submit results of evaluating nitrate loading potential factor (high, medium, or low)	1 Yr
Tier 3 dischargers ***with a high nitrate loading potential*** must submit verification of Irrigation and Nutrient Management Plan (INMP) and other related nitrate loading and balance information	2 Yrs
Tier 3 dischargers must submit Water Quality Buffer Plan to prevent waste discharge or water quality degradation, ***if their operations contain or are adjacent to a waterbody identified on the Clean Water Act Section 303(d) List of Impaired Waterbodies as impaired for sediment, temperature or turbidity.***	4 Yrs

2.2.2 Costs of Implementing Management Practices

2.2.2.1 Estimated Costs of New Compliance Actions

The scope of this cost analysis is intended to encompass the incremental costs to growers and landowners of new compliance actions beyond those taken to comply with the 2004 Conditional Waiver. Compliance actions for the Draft Ag Order are attached to a schedule (Table 1, above) and staff recognizes these actions may include the implementation of management practices in addition to those already implemented in response to the 2004 Conditional Waiver. However, staff possesses limited information to determine the extent of management practice implementation to date. Consequently, staff can not quantify the incremental costs associated with additional management measures. Staff assumes that many growers will not have to incur entirely new cost of implementing management practices as they will have already implemented some practices for compliance with the 2004 Conditional Waiver. Growers and landowners are likely to implement only some of the actions described below. The higher the assumed rate of management practice implementation over the past nearly seven years, the lower is the incremental increase in cost of the 2011 Draft Ag Order. This analysis provides an estimate of total costs, but the Water Board does not expect that each grower will be subject to all the costs identified since it is up to the grower to choose and implement management practices specific to its situation.

2.2.2.2 Potential Water Quality Management Practices

A broad choice of water quality management practices is available to growers to achieve compliance with the Draft Ag Order. Practices include those designed to manage sediment, nutrients, pesticides, and aquatic habitat. Growers implement many of these management practices for purposes other than water quality protection and staff makes no estimation of the proportion of practices that growers have implemented, or will implement, exclusively for water quality protection.

Most management practices contribute to meeting multiple management objectives (Table 2). For example, management practices implemented to capture and treat irrigation water runoff (tailwater) before it leaves the farming operation can result in improved irrigation efficiency and reduced transport of multiple constituents off-site, including nutrients, sediment and pesticides. Similarly, management practices that emphasize source control, such as nutrient management planning, reduce the need for more expensive management practices to remove a pollutant from tailwater before it enters receiving waters.

Source control practices also provide cost savings to growers who reduce their use of irrigation water and agricultural chemicals. These cost savings potentially combine with other benefits to reduce the cost of management practice implementation. Reduced water use, energy use, labor costs for irrigation and fertilization, and chemical use are all examples of benefits with potential to decrease costs to dischargers (Table 2).

2.2.2.3 Potential Cost Factors Considered

Staff evaluated detailed implementation requirements for management practices to identify specific costs of management practice implementation (Table 2). For example, the practice of installing backflow prevention and safety devices has a direct cost associated with purchasing and installing the devices and various related costs to the farming operation, including potential system upgrades to accommodate backflow prevention devices and regular maintenance of backflow prevention devices.

The specific combination of management practice actions undertaken by growers will be unique to the water quality conditions of each operation and will vary widely. To further illustrate the types of costs associated with management practice implementation, Table 3 describes typical activities that incur costs in managing sediment and stormwater, nutrients, pesticides, irrigation, and riparian habitat on farms in the Central Coast Region. Management practices include costs associated with assessment, on-the-ground actions, and technical assistance.

Table 2: Water Quality Management Practices with Potential to Change Costs to Dischargers

WATER QUALITY MANAGEMENT PRACTICES WITH POTENTIAL TO INCREASE COSTS TO DISCHARGERS	DETAILS OF IMPLEMENTATION REQUIREMENTS FOR WATER QUALITY MANAGEMENT PRACTICES	BENEFITS WITH POTENTIAL TO DECREASE COSTS TO DISCHARGERS	*Implementation Achieves Management Objectives for:*			
			Irrigation	***Nutrients***	***Erosion***	***Pesticide***
Eliminate or reduce irrigation runoff through installation and management of a highly efficient irrigation system	Weather station equipment and/or data Expertise/ technical assistance in crop growth, soil science, atmospheric demand, irrigation requirements and economics to prepare an irrigation strategy Labor for installation, operation, and maintenance Direct cost of equipment/system investment	Reduced water use Reduced energy use Reduced agro-chemical use Reduced labor for fertilizer applications Reduced labor through fewer irrigations	✓	✓	✓	✓
Capture and treat irrigation water runoff before it leaves the farming operation	Land out of production to collect tailwater Design and implementation of a tailwater recovery system that collects all discharge Direct cost for recovery/recycle system components Labor for installation, operation, and maintenance Design and implementation of a tailwater treatment system Management time to create and implement a monitoring plan that verifies treatment: collect water samples; evaluate results of samples and recalibrate treatment system	Reduced water use Reduced energy use Reduced need for additional conservation practices Reduced time dealing with clean-ups associated with chemical contamination of other farm water supplies/systems Reduced agro-chemical use	✓	✓	✓	✓
Install backflow prevention and safety devices	Purchase of backflow prevention device Labor for installation and regular maintenance of backflow prevention device Potential system upgrades to accommodate backflow prevention device Expertise/technical assistance	Reduced time and cost dealing with clean-ups associated with chemical contamination of other farm water supplies/systems Reduced agro-chemical use		✓		✓
Conduct analysis of salts to limit unnecessary leaching	Reduced yield from growing current crops with higher salinity in irrigation water Less profit from growing alternative, salt-tolerant crops/varieties Proper training for the collection of samples Labor for the collection of soil samples and water samples Laboratory costs for salinity tests that identify salt problems in soil	Reduced water use and cost by altering irrigation schedule for less frequent heavy watering Reduced energy use to not pump extra water for leaching salts Reduced fertilizer costs by keeping nutrients at the root zone instead	✓	✓		

WATER QUALITY MANAGEMENT PRACTICES WITH POTENTIAL TO INCREASE COSTS TO DISCHARGERS	DETAILS OF IMPLEMENTATION REQUIREMENTS FOR WATER QUALITY MANAGEMENT PRACTICES	BENEFITS WITH POTENTIAL TO DECREASE COSTS TO DISCHARGERS	*Implementation Achieves Management Objectives for:*			
			Irrigation	***Nutrients***	***Erosion***	***Pesticide***
	Expertise/technical assistance to interpret results	of leaching				
Stormwater Management Plan to control, stop, and/or eliminate the release of pollutants from farms to surface waters	Management time to: prepare a stormwater management plan coordinate with other growers and agencies submit plan to Central Coast Water Board oversee implementation of management plan continually review and update management plan Labor associated with implementation Implementation and structural improvements Labor for continued maintenance Expertise/technical assistance to help develop measures, strategies, practices, etc.	Reduced need for additional conservation practices	✓	✓	✓	✓
Dredge, remove, and dispose of sediments from treatment systems every year, before the first rain event	Management time to oversee dredging operation Labor to operate heavy equipment Rental/use of heavy equipment Disposal of contaminated soil Re-vegetating treatment system				✓	✓
Drainage Water Management Program for Dischargers who operate tile drains or other sub-surface drainage systems	Expertise/technical assistance to assist with system design and program Modification of drainage system design and operation Equipment cost for water control structures and/or retrofits Installation of structures Management time to operate structures at appropriate times	Reduced water use Reduced energy use	✓	✓		✓
Develop, implement, and periodically update a Nutrient Management Plan that is approved by a Certified Crop Advisor, a PE, GR, or similarly certified professional	Acquire technical assistance to help measure, calculate, budget, and/or estimate nutrient requirements, uptake, application, including consultant costs to review and approve management plan (CCA, PE, CR, etc.) Train on how to measure, calculate, budget, estimate, and apply nutrients Management time to oversee implementation of management	Reduced energy use Reduced agro-chemical use Reduced labor for fertilizer applications Reduced labor through fewer applications Increased crop yields		✓		

WATER QUALITY MANAGEMENT PRACTICES WITH POTENTIAL TO INCREASE COSTS TO DISCHARGERS	DETAILS OF IMPLEMENTATION REQUIREMENTS FOR WATER QUALITY MANAGEMENT PRACTICES	BENEFITS WITH POTENTIAL TO DECREASE COSTS TO DISCHARGERS	*Implementation Achieves Management Objectives for:*			
			Irrigation	***Nutrients***	***Erosion***	***Pesticide***
	plan; continually review and update management plan Labor for implementation Direct costs associated with implementation Labor associated with continued maintenance					
Estimate loading of nutrients directly below the root zone	Direst cost for measurement equipment Management time and labor for installation and maintenance Management time for regular checks and pumping for sampling Laboratory analysis of samples Management time evaluate sample and make appropriate system changes Hire consultant to collect samples or proper training for employees to collect samples	Reduced water use Reduced energy use Reduced labor for fertilizer applications Reduced agro-chemical use Reduced labor through fewer irrigations	✓	✓		✓
Trap residual fertilizers (and nutrients) in the root zone, between crop rotations	Soil testing and measurements Management time to analyze results and make appropriate fertilizer application changes Installation of leaching reduction (nutrient trapping) control practices	Reduced fertilizer use Reduced energy use Reduced water use and costs for leaching fertilizer to root zone	✓	✓	✓	✓

Table 3: Example Types of Management Practice Implementation Costs

PLANNING AND ASSESSMENT COSTS	ON-THE-GROUND COSTS	COST OF TECH ASSISTANCE
SEDIMENT / EROSION CONTROL / STORMWATER MANAGEMENT		
Prepare Stormwater Management Plan Measure runoff from field Implement smart irrigation scheduling Install and monitor weather station	Construct stormwater storage facility Construct sediment basin Residue and tillage management Re-grade to alter drainage Plant cover crop, filter strips, field borders, grassed waterways, etc. Apply polyacrylamides (PAM)	Consulting fees for technical assistance to implement Stormwater Mgmt. Plan
IRRIGATION MANAGEMENT		
Install and monitor weather station Conduct irrigation system evaluation on a drip, sprinkler, and/or furrow irrigation system Measure soil moisture content Implement smart irrigation scheduling Install flow meter on a pipeline Measure runoff from a field	Convert to drip irrigation from either sprinkler or furrow irrigation, Install dual drip and sprinkler system for frost control Repair and/or replace sprinkler system Install filter station for drip irrigation system Install time clock for irrigation pump Install automatic equipment such as a shut-off switch, backflow prevention device (when chemigation is used) Construct furrow irrigation tailwater recovery/recycling system, including storage facilities Construct water holding structure Construct underground detention / retention unit for tailwater recovery/recycling system	Retain irrigation scheduling service that provides growers with written reports of soil and crop status information throughout the growing season, as well as a seasons end agronomic report
NUTRIENT AND SALT MANAGEMENT		
Prepare Nutrient Management Plan Measure soil moisture content Measure runoff from a field Install and monitor weather station Install shallow groundwater monitoring well Do laboratory well water analysis Do laboratory soil analysis	Install automatic equipment such as a shut-off switch, backflow prevention device Time for a manager and an irrigator to improve the irrigation efficiency and water management (including research, education, and information gathering) Install time clock for irrigation pump to improve irrigation scheduling The cost of additional PVC pipe runs Install or improve sprinkler irrigation system Nutrient trapping Effective cover crops	Consulting fees for technical assistance to implement a nutrient management plan
PESTICIDE RUNOFF / TOXICITY ELIMINATION		
Conduct smart irrigation scheduling Install and monitor weather station Install flow meter on pipeline Do laboratory well water analysis Do laboratory soil analysis	Purchase and install wellhead protection block Install automatic equipment such as a shut-off switch, backflow prevention device Install dual drip and sprinkler system Establish windbreaks/shelterbelts to reduce pesticide drift Apply polyacrylamides (PAM) Construct furrow irrigation tailwater recovery/recycling system Construct underground detention/retention unit for a tailwater recovery/recycling system	The cost of technical assistance to implement an Integrated Pest Management Plan (IPM)
AQUATIC HABITAT PROTECTION		
Prepare Water Quality Buffer Plan	Erosion Control Modify drainage infrastructure Plant riparian vegetation Install irrigation Monitoring and maintenance (for several years to ensure success) Stream bank and channel re-contouring Weed (invasive vegetation) management	Consulting fees for technical assistance to implement a nutrient management plan

2.2.2.4 Unit Costs for Management Practices

This Technical Memo presents unit cost information for the common management practices available to dischargers to achieve compliance with the Draft Ag Order. Staff reviewed information from the United States Department of Agriculture Natural

Resources Conservation Service, the University of California Cooperative Extension (UCCE), and obtained cost quotes from numerous agricultural technical consultants and growers.

2.2.2.4.1 UCCE Conservation Practices

UCCE prepared estimates of costs and potential benefits for a selection of common conservation practices employed in the Central Coast Region. UCCE estimated low, representative, and high costs for the installation and maintenance of the conservation practices. UCCE emphasizes that farmers, ranchers and landowners should evaluate each conservation practice for potential benefits and drawbacks with respect to their own operation.[2] Furthermore, UCCE states their assumptions in preparing the estimates. For example, UCCE did not include in the analysis land ownership and rental rates, which are specific to each operation. Also, the estimates reflect current prices as of 2003, when the studies were prepared.

Table 4 presents a summary of UCCE's cost estimates for nine conservation practices. The complete UCCE studies detail specific actions required to implement each practice and break out costs by machine and non-machine labor, material costs, and annual operation and maintenance costs for up to five years of implementation.

Costs and reduced returns refer to direct costs for practice installation, operation and maintenance, and any negative impact on returns. Two practices, non-engineered water/sediment control basins, and underground outlets, include reduced returns of up to $1,125 from the removal of 0.1 acre of strawberry from production. The representative net change in income for these two practices however, is the greatest of all the practices studied: non-engineered water/sediment control basins ***decrease*** income by -$1,367/unit/year while underground outlets ***increase*** income by $1,332/unit/year, over the longer term (four to five years), according to UCCE. These positive and negative effects of implementing conservation practices illustrate how a reduction in returns does not necessarily translate into a reduction in income.

As expected, most conservation practices UCCE evaluated result in a negative effect on income that may be reduced after the initial year of implementation. For example, critical area planting may cost $903/acre in the first year of implementation, but in years 2 – 4, that cost could go down to $121/acre/year.

[2] University of California Cooperative Extension, 2003. Estimated Costs and Potential Benefits for [Nine Conservation Practices] http://www.awqa.org/pubs/coststudies.html

Table 4: Cost Estimates and Potential Benefits for Nine Conservation Practices

CONSERVATION PRACTICE	COSTS PER UNIT		
	Low	**Representative**	High
Annually Planted Cover Crop			
Costs & Reduced Returns	$48	$147	$163
Additional Returns & Reduced Cost	$0	$28	$110
Net Change in Income Per Acre	***-$48***	***-$119***	***-$53***
Annually Planted Grassed Filter Strip (0.5 ac)			
Costs & Reduced Returns	$26	$234	$580
Additional Returns & Reduced Cost	$0	$165	$220
Net Change in Income Per Unit Per Year	***-$26***	***-$69***	***-$360***
Grassed Farm Roads (5,800 Linear Feet/20 ac of Cropland)			
Costs & Reduced Returns	$137	$310	$503
Additional Returns & Reduced Cost	$0	$650	$1,950
Net Change in Income Per Unit (5,800 Linear Ft.) Per Year	***-$137***	***$340***	***$1,447***
Non-Engineered Grassed Waterways (1,000 Linear Ft.)			
Costs & Reduced Returns Per Unit Year 1	$28	$980	$2,250
Costs & Reduced Returns Per Unit Per Year - Years 2-5	$27	$329	$767
Additional Returns & Reduced Cost Per Unit Year 1	$0	$275	$660
Additional Returns & Reduced Cost Per Unit Per Year -Years 2-5	$0	$275	$660
Net Change in Income Per Unit Year 1	***-$28***	***-$705***	***-$1,590***
Net Change in Income Per Unit Per Year - Years 2-4	***-$27***	***-$54***	***-$107***
Non-Engineered Water/Sediment Control Basin (237 Cubic Yards)			
Costs & Reduced Returns Per Unit Year 1	$1,698	$4,061	$7,002
Costs & Reduced Returns Per Unit Per Year - Years 2-5	$354	$2,017	$3,751
Additional Returns & Reduced Cost Per Unit Per Year	$0	$650	$1,950
Net Change in Income Per Unit Year 1	***-$1,698***	***-$3,411***	***-$5,052***
Net Change in Income Per Unit Per Year - Years 2-4	***-$354***	***-$1,367***	***-$1,801***
On-Farm Row Arrangement (25 Acre Parcel)			
Costs & Reduced Returns Per Unit Per Year**	$474	$920	$1,849
Additional Returns & Reduced Cost Per Unit Per Year	$0	$3,500	$7,000
Net Change in Income Per Unit Per Year	***-$474***	***$2,580***	***$5,151***
Net Change in Income Per Acre Per Year	***-$19***	***$103***	***$206***
** First year costs are $125 higher than subsequent years to account for costs to purchase measuring devices			
Perennial Critical Area Planting (Acre)			
Costs & Reduced Returns Per Unit - Year 1	$394	$903	$1,780
Costs & Reduced Returns Per Unit Per Year - Years 2 - 5	$50	$121	$241
Additional Returns & Reduced Costs Per Unit Per Year - Years 1-5	$0	$0	$0
Net Change in Income Per Acre Year 1	***-$394***	***-$903***	***-$1,780***
Net Change in Income Per Acre Per Year - Years 2-5	***-$50***	***-$121***	***-$241***
Perennial Hedgerow Planting (1,000 Linear Ft. X 8 Ft.)			
Costs & Reduced Returns Per Unit Year 1	$1,276	$2,918	$3,938
Costs & Reduced Returns Per Unit Per Year - Years 2-5	$280	$515	$739
Additional Returns & Reduced Cost Per Unit Per Year	$0	$0	$0
Net Change in Income Per Unit (1,000 LF) Year 1	***-$1,276***	***-$2,918***	***-$3,938***
Net Change in Income Per Unit Per Year - Years 2-5	***-$280***	***-$515***	***-$739***
Underground Outlet (400 Linear Ft.)			
Costs & Reduced Returns Per Unit Year 1	$4,630	$5,918	$6,834
Costs & Reduced Returns Per Unit Per Year - Years 2-5	$91	$726	$1,362
Additional Returns & Reduced Cost Per Unit Per Year	$0	$2,058	$4,062
Net Change in Income Per Unit Year 1	***-$4,630***	***-$3,860***	***-$2,772***
Net Change in Income Per Unit Per Year - Years 2-5	***-$91***	***$1,332***	***$2,700***

2.2.2.4.2 Sample Per-Unit Costs from NRCS and Other Sources

The detailed analysis of potential costs and benefits of practice implementation developed by UCCE covers soil conservation practices principally supporting sediment/erosion control and stormwater management objectives. A variety of management practices are available to address other management objectives identified in the Draft Ag Order, including: irrigation management, nutrient and salt management, pesticide runoff/toxicity elimination, and aquatic habitat protection. A broad sample of the per-unit costs associated with these practices is presented in Table 5.

The UCCE cost studies illustrate the variable effect of practice implementation on the bottom line of farming operations. As the UCCE cost studies show, and as Table 2 describes, most practices do yield benefits that improve overall conditions for farming operations, potentially reducing, and in some cases completely covering, the direct cost of implementation. The cost information presented in Table 5, by contrast, simply identifies per unit costs and includes no estimate of potential effects on returns, be they positive or negative.

The practices described in Table 5 range from planning and assessment actions to on-the-ground changes to field operations, including, for example, purchasing or replacing new equipment, constructing new facilities, and managing edge-of-field vegetation for habitat protection. The highest per-unit costs are associated with facility construction. For example, stormwater basins, tailwater recovery facilities, and monitoring wells can exceed several thousand dollars per facility. Habitat restoration and revegetation costs are substantial as well on a per-acre basis, including stream habitat improvement and management costs of approximately $10,000/acre, according to NRCS.

Irrigation management includes several costly practices (in excess of $3,000 per unit). The costs to improve irrigation efficiency may include assessment activities, equipment upgrades, and storage facility construction that represent significant investments for growers. Investments in irrigation efficiency however, may have the greatest potential of all the management practices to generate a stream of benefits that over time are likely to decrease costs for water and energy use. Most critically, irrigation efficiency improvements that result in the elimination of tailwater runoff from the operation allow the grower to avoid the costs of monitoring and treating tailwater discharges.

Table 5: Sample Per-Unit Costs of Management Practices Benefiting Water Quality

MANAGEMENT PRACTICE	DESCRIPTION	UNIT	UNIT COST*	COST RANGE		SOURCE
				Low	High	
SEDIMENT/EROSION CONTROL/STORMWATER MANAGEMENT						
Conservation Cover	Orchard/Vineyard Floor Cover	Acre		$429.91	$690.18	1
	Erosion Control, Water Quality, Wildlife	Acre		$569.71	$1,255.34	1
	Permanent Native Cover; Prep, Seed/Seeding, Weed Control	Acre		$1,252.76	$1,445.26	1
	Perm Native Cover Arid Lands; Prep, Seed/Seeding, Weed Control	Acre		$1,271.81	$1,736.81	1
Conservation Crop Rotation	Rotation for IPM/Organic/SCI/Erosion	Acre	$394.36			1
Cover Crop	Cover Crop	Acre		$159.14	$249.14	1
Cover Crop for Roads	Seasonal Road Cover, Non-Irrigated	Acre	$96.06			1
Residue and Tillage Management	Residue Management	Acre		$50.88	$61.14	1
Sediment Basin	Embankment Sediment Basin <1,200 CYD	No.	$8,190.00			1
	Embankment Sediment Basin	CYD	$3.15			2
Well Decommissioning	1,000-foot deep, 6-inch diameter	Foot	$3.75			1
	30-foot deep, 48-inch diameter	Foot	$140.65			1
Field Border	Seedbed Preparation, Seed	Acre		$392.46	$969.18	1
Filter Strip	Seedbed Prep, Seeding	Acre		$461.68	$1,015.30	1
Grassed Waterway	Grassed Waterway	Acre		$811.88	$1,246.58	1
Underground Outlet	4" diameter	Foot		$5.95	$19.82	1
	12" diameter	Foot		$19.82	$49.52	1
Polyacrylamides Erosion Control	Furrow erosion control	Acre	$50.00			1
Mulching	Soil Fertility, Moisture, Weed & Erosion Control	Acre		$314.05	$807.50	1
	Soil Cover - Moisture, Weed, Erosion Control	Acre				1
Stormwater Management Plan	Stormwater Management Plan for typical scale operation	-		$3,000.00	$1M	3
Greenhouse Covering	Permanent covering construction costs	Sq. Ft.		$6.00	$12.00	24
IRRIGATION MANAGEMENT						
Irrigation System, Microirrigation	Row-Field Cropland	Acre		$990.00	$1,500.00	1
	Nursery or Greenhouse	Acre	$3,000.00			1
	Orchard/vineyard <10 ac and >10ac	Acre		$1,400.00	$2,000.00	1
	Micro Irrigation on Hillside	Acre	$1,500.00			1
	Upgrade media filter tank	Each	$4,500.00			1
	Upgrade media filter station	Each	$15,000.00			1
	Upgrade screen or disk filter unit	Each	$1,800.00			1
	Upgrade screen or disk filter station	Each	$7,000.00			1
Drip irrigation	Materials and installation (w/filter station) new system in vineyard	Acre	$2,353.00			4
	New wellhead protection block	Each	$8,000.00			5

MANAGEMENT PRACTICE	DESCRIPTION	UNIT	UNIT COST*	COST RANGE		SOURCE
Row Arrangement	Row Arrangement Moderate to Steep Slope	Acre		$100.00	$150.00	1
Water and Sediment Control Basin	Embankment, <1,200 CYD	Each	$8,190.00			1
	Earthen Reservoir	Acre-Ft	$1,020.00			1
Irrigation Regulating Reservoir	Tank, <15K gal	Gal	$1.00			1
Pond Sealing or Lining, Soil Cement	Pond Sealing, Soil Cement	SqFt	$0.72			1
Roof Runoff Structure	Rain Gutters & Downspouts	Foot	$11.64			1
Water Harvesting Catchment	Storage Tank	Each		$2,500.00	$3,500.00	1
	Catchment	Each	$1,500.00			1
Runoff Management System	Runoff Management System	Each	$10,000.00			1
Tailwater Recovery System	Installed in: Crop/Pasture	Acre		$153.00	$306.00	1
	Installed in: Nursery	Acre		$1,632.00	$2,550.00	1
	Excavated pond/basin/catchment	CYD	$1.58			2
	Embankment pond/basin/catchment	CYD	$3.15			2
	Underground detention/retention unit	CuFt	$6.00			6
Irrigation Efficiency Measurement	Equipment to measure applied irrigation water	Each		$800.00	$1,200.00	7
	Equipment Installation	Each	$500.00			7
	Mobile Irrigation Lab: measure Distribution Uniformity (furrow length)	1/4 Mile		$950.00	$1,100.00	8
		1/2 Mile		$1,250.00	$1,450.00	8
	Equipment to measure runoff from a field: flume with a stilling well and pressure transducer	Each		$2,200.00	$2,600.00	7
Consulting Costs for Irrigation Management Plan Implementation	Irrigation Scheduling Service: monitor soil moisture 1/wk; recommend irrigation timing; reports, yield analysis; 2 visits/week	Acre		$20.00	$45.00	8
	Single irrigation scheduling visit	Acre	$3.50			8
NUTRIENT AND SALT MANAGEMENT						
Nutrient Management	Implemented for Seasonally Planted Crops	Acre	$55.00			1
	Implemented for Tree and Vine Crops	Acre	$56.00			1
Irrigation/Chemigation System Improvements	Backflow Prevention Check Valves	Each		$95.00	$435.00	9
	Chemigation Check Valves	Each		$597.00	$1,097.00	9
	Ancillary Equipment: smaller check valves, switches, controllers	Each		$21.00	$134.00	9
	Chemical injection pump	Each	$1,022.00			9
Vegetated Treatment Area	Vegetated Treatment Area	Acre	$404.00			1
Fertilizer Additives to Increase Nitrogen Utilization by Crop	Additive (urease inhibitor) to nitrogen-based fertilizers	Per pound of Fertilizer		4.5 cents	6 cents	10
Equipment to Measure Soil Moisture, Crop Water Demand, Evapotranspiration	Tensiometer	Each		$70.00	$120.00	11
	Atmometer equipped with a data logger. ETgage Model E	Each	$608.00			13
	ETGage Model A	Each	$192.00			13
Quantifying Nutrients in	Groundwater Monitoring Well (shallow, 40-ft)	Each	$6,000.00			14

MANAGEMENT PRACTICE	DESCRIPTION	UNIT	UNIT COST*	COST RANGE		SOURCE
Groundwater	Laboratory analyses of water sample	Each	$55.00			15
	Laboratory analyses of soil sample	Each		$40.00	$60.00	15
Equipment Rental to Measure Soil Moisture and Service to determine actual Crop Water Demand	4 tensiometers and central communication unit	Acre/Yr	$152.00			12
Consulting Costs Associated with Nutrient Management Plan Implementation	Crop logging service (tissue sampling prior to each side dress and irrigation, record keeping of pertinent agronomic information such as varieties, irrigations, fertilizer applications, and yield; season end agronomic report with cost, and yield analysis)	Acre/Yr		$11.10	$19.47	8
	Field sampling and consulting fee: Sampling, GPS, Report	Day	$766.00			8
		Acre	$20.00			8
	Certified Crop Advisor	Hour		$120.00	$240.00	18
PESTICIDE RUNOFF/TOXICITY ELIMINATION						
Pest Management	Year-Round IPM Level 1	Acre		$88.00	$160.00	1
	Reduced Risk Level 1	Acre		$45.00	$117.00	1
	Basic IPM consulting; Wine Grapes	Ac/Yr	$22.00			17
	Basic IPM consulting: Pears	Ac/Yr	$40.00			17
	High Cost Organic Pest Management Practices	Acre	$72.00			1
	Pest Suppression during Transition to Organic	Acre	$95.00			1
Precision Pest Control Application	Precision Spray Technology	Acre	$60.00			1
	Fumigant, Sprinklers for crop irrigation and VOC control	Acre	$40.00			1
Consulting Services	IPM and related consultations by: Certified Professional Agronomist, Accredited Farm Manager, Accredited Rural Appraiser, Certified Professional Soil Scientist	Hour		$110.00	$250.00	18
		Acre		$5.00	$20.00	19
Windbreak/Shelterbelt Establishment	Direct costs to implement practices to reduce drift	Foot	$1.76			20
Tailwater Recovery/Recycling System	Waste Utilization	Acre		$9.00	$10.00	20
	Storage Facility	Each		$13,000.00	$18,000.00	20
	Water Structure	Each		$1,000.00	$1,200.00	20
Products to Treat Water to Reduce Pesticide Content	PAM total cost per acre; includes product, labor, other	Acre	$25.70			22
	PAM: Liquid; 2 to 3 applications/year to wine grapes	Ac/Yr		$54.00	$81.00	23
AQUATIC HABITAT PROTECTION						
Critical Area Planting	From seed to establishment	Acre		$1,043.56	$4,673.70	1
Channel Bank Vegetation	Native Tree & Shrub Establishment	Acre	$3,324.28			1
Stream Habitat Improvement and Management	Stream Improvement	Acre	$10,027.20			1
Channel Stabilization	Bioengineered Stabilization	Foot	$50.00			1
Riparian Herbaceous Cover	Native Seed, Drilled	Acre	$1,085.86			1

MANAGEMENT PRACTICE	DESCRIPTION	UNIT	UNIT COST*	COST RANGE		SOURCE
	Native Species, Plugs	Acre	$4,392.40			1
Riparian Forest Buffer	Establishment	Acre		$640.05	$2,282.25	1
Hedgerow Planting	Hedgerow Planting	Foot		$2.25	$4.07	1
Restoration and Management of Rare and Declining Habitats	Arundo Eradication	Acre		$1,000.00	$4,310.00	1
	Blackberry Eradication	Acre		$1,142.50	$3,770.00	1
	Perennial Pepperwood Eradication	Acre		$79.00	$180.00	1
	Thistle or Other Invasive Eradication	Acre		$84.50	$129.00	1
	Wildlife Structures	Acre		$20.00	$40.00	1
Establishing Upland Wildlife Habitat	Irrigation System, Microirrigation	Acre	$800.00			1
Native Perennial Herbaceous Veg.	Irrigation System, Microirrigation	Acre	$1,678.16			1
Wetland Wildlife Habitat Mgmt.	Various Intensity	Acre	$20.00	$100.00		1
Constructed Wetland	Constructed Wetland	Acre	$4,351.76			1
Wetland Restoration	Wetland Restoration - Shaping & Grading	Acre	$330.76			1
	Wetland Restoration - Planting Only	Acre	$1,282.64			1
	Wetland Restoration - Southern California	Acre	$595.82			1
	Wetland Restoration - Coast	Acre	$2,470.58			1
Wetland Enhancement	Various Intensity	Acre		$55.00	$205.00	1
Tree/Shrub Site Preparation	Hand Site Preparation, Light	Acre	$1,045.00			1
Early Successional Habitat Development/Management	Early Successional Habitat Management	Acre	$25.00			1

* A low to high range is provided where available. The reported unit cost from Natural Resources Conservation Service (NRCS), Environmental Quality Incentives Program (EQIP) source is two times the unit cost provided by NRCS. Costs provided by NRCS are based on EQIP Program's cost basis for financial assistance, which is one-half the cost to implement the practice (personal communication, Roney Gutierrez, NRCS)

SOURCES for Table 5:

1 Natural Resources Conservation Service (NRCS), Environmental Quality Incentives Program 2010 Cost Tables, provided by Roney Gutierrez, NRCS.
2 Beau Schoch - Engineer USDA - NRCS Salinas Service Center
3 Dale Gropp, former Civil Engineer Technician at Cachuma RCD
4 Quote from Pacific Ag Water, Santa Maria
5 Coastal nursery manager re: installation of a new block Sept-Nov 2008
6 Hanes Geo Components, Area Sales Manager
7 USDA Engineer, NRCS Coastal RCD
8 Irrigation consultant and CCA who wishes to remain anonymous
9 Quote from Pacific Ag Water, Santa Maria
10 Regional Manager, Agrotain International
11 Irrometer, Google devices and Ben Meadows; ETgage Company
12 Hortau Simplified Irrigation
13 ETgage.com; ETgage Company rep., Loveland, CO
14 RWQCB, NPS Section 319 proposal for Pinto Lake grant
15 A&L Western laboratories
16 Numerous Certified Crop Advisors quotes for services
17 Devin W. Gordon, AG Unlimited, Ukiah, CA
18 Numerous Pesticide Crop Advisors quotes for services
19 Pesticide Crop Advisor, Yuba City, CA; Devin W. Gordon, AG Unlimited
20 NRCS online EQIP data for Pacific Region: http://www.ers.usda.gov/Data/eqip/
22 Michael Cahn, Irrigation Specialist UC Cooperative Extension, Davis
23 Stillwaters Aviation
24 California Association of Nurseries and Garden Centers, March 30, 2010 letter to staff. http://www.waterboards.ca.gov/centralcoast/water_issues/programs/ag_waivers/docs/ag_order/group_2.pdf

Management practices vary in terms of scope, making it difficult to identify actual costs of practices. For example, a runoff management system ($10,000 each) may include several of the individual tailwater recovery practices listed separately at lower per-unit cost, such as excavated pond/basin/catchments at $1.58/cubic yard excavated. Table 5 is therefore intended to provide as broad a sample as possible from available information, and to illustrate the range of options available for selecting the appropriate suite of practices to achieve specific management objectives. While entries are listed under management practice categories, there is considerable overlap among the categories. For example, tailwater recovery is a management practice supporting both irrigation and pesticide runoff management objectives. For the purposes of complying with the Draft Ag Order, a grower's selection of a particular management practice would be based on the effectiveness and extent of existing practices and water quality issues specific to the operation.

2.2.2.4.3 Management Cost Estimates from the Central Valley Region

Table 6 provides cost figures from the Central Valley Water Board to compare with Table 5 and UCCE expenditures (Table 4) above. The starkly different costs reported for the low and high cost ranges, as well as among the various sources available, point to the level of uncertainty associated with any estimates of actual individual or cumulative cost of management practice implementation.

Table 6: Management Practice Costs for Central Valley Water Board Region

Management Practice	Cost Range	Source of Information*
Nutrient Management	$5–$9/acre-year excludes idle land	Blackman 2010; Fry 2010; Kasapligil 2010; and Rathburn 2010
Irrigation Water Management	$50–$88/acre-year excludes idle land	Fry 2010; IID 2007
Tailwater Recovery System	$89/acre-year	NRCS 2010; IID 2007
Pressurized Irrigation System	$160/acre-year	NRCS 2010; IID 2007
Cover Crop	$48/acre-year	Tourte and Buchanan 2003a, b, c
Buffer Strip-Sediment Trap	$1/acre-year	Tourte and Buchanan 2003a, b, c
Abandoned Well Protection	$250/well/year	Lewis 2010
IID = Imperial Irrigation District, NRCS = Natural Resources Conservation Service, UCCE = University of California Cooperative Extension.		

* Secondary sources cited in CVRWQCB, 2010, p. 2-17.

2.2.2.4.4 Discharger Estimates of Cost

Groups representing dischargers provided cost information to the Water Board in response to the February 1, 2010 release of Preliminary Draft Staff Recommendations for an updated Agricultural Order. The information, presented in letters[3] and public comments at two Public Workshops (May 12 and July 8, 2010), reported on information

[3] Grower-Shipper Association of Central California, March 31, 2010 and May 5, 2010 letters to Central Coast Water Board Chair Jeffrey Young; Central Coast Agricultural Water Quality Coalition April 1, 2010 letter to Jeffrey Young.

collected through various methods including surveys and interviews with grower members, and economic modeling to estimate the economic effects of staff's draft recommendations. The results were gross estimates and indicated a wide range of approximate values for per acre costs of compliance in select crops, and county and regional losses to: business revenues, indirect tax revenue, labor income, and jobs.

The discharger representatives' estimates were based on the February 1, 2010 Preliminary Draft Staff Recommendations, and on assumptions about monitoring requirements, which were not included in those Staff Recommendations. The stated requirements in the February Preliminary Draft Staff Recommendations and any assumptions about their implementation are no longer valid, since staff has modified the Draft Ag Order.

2.2.2.5 Conclusions on Cost of Management Practice Implementation

Most water quality management practices achieve multiple objectives, though they often vary in terms of scope, making it difficult to identify actual costs. Management practices typically result in costs that lessen after the initial year of implementation. Detailed studies of implementation costs illustrate both positive and negative effects and reveal that a reduction in returns does not necessarily translate into similar effects on income. Most practices do yield benefits that improve overall conditions for farming operations, partially reducing the direct cost of implementation.

The highest per-unit costs are associated with management practices that require facility construction. Habitat restoration and revegetation costs can be substantial on a per-acre basis. Investments in irrigation management practices may have the greatest potential to generate a stream of benefits that over time support cost-effective farming operations. Notably, irrigation efficiency improvements that result in the elimination of tailwater runoff from the operation allow the grower to avoid the costs of treating discharges.

For the purposes of complying with the Draft Ag Order, a grower's selection of a particular management practice would be based on the effectiveness and extent of existing practices, and on water quality conditions specific to the operation. However, starkly different costs reported for the low and high cost ranges, as well as among the various sources available, point to the level of uncertainty associated with any estimates of actual individual or cumulative cost of management practice implementation. Furthermore, staff possesses limited information to determine the extent of management practice implementation to date.

Staff therefore applied best professional judgment and conservative assumptions in constructing an estimate of total cost for management practice implementation. Staff estimated costs in five management practice categories using median costs/acre for practices in each category (Table 7). The categories were then summed and total costs for the first year and for all five years of the program were calculated.

In the absence of information about the current extent of management practice implementation, staff made assumptions concerning the number of acres to which dischargers might apply management practices to achieve compliance with the Draft Ag Order. For practices to manage sediment, erosion and stormwater, staff conservatively assumed the basis, or the area potentially requiring management improvements, to be all irrigated farmland. However, staff then used a correction factor of five percent to estimate the number of acres that might be subject to actual management to reduce erosion, sedimentation and stormwater impacts to water quality.

The management practice cost per acre was derived from the broad selection of costs staff compiled and reported in Table 5. Staff calculated the median of all reported values presented in cost per acre, using the high value of the cost range where available to maintain a conservative bias. This cost per acre value was then applied to the acres that might be subject to management practice implementation.

Staff followed this approach for each management practice category, using a different area basis and correction factors based on professional judgment. For example, the basis for irrigation management was assumed to be operations that generate tailwater and staff assumed 50 percent of these acres might be subject to implementation of an irrigation management practice. For nutrient and salt management practices, staff used the total acreage planted in vegetables as a basis, since vegetables have a higher potential to load groundwater with nitrogen. For both pesticide runoff/toxicity elimination and aquatic habitat protection, staff used the number of operations along listed waterbodies as a basis for calculating acres subject to practice implementation. Staff used the median operation size of 20 acres as the multiplier for estimating the acres potentially requiring treatment for pesticide/toxicity elimination.

Costs for the first year of implementation was the basis for calculating costs in subsequent years, which staff assumed would be from 10 to 50 percent of the first year's cost. Staff did not account for the Draft Ag Order's sequencing of compliance milestones (e.g., aquatic habitat management is not required for Years 1-5, but rather by Year 3), and as a result the estimate of costs for the entire five-year program is higher than it would be if staff assumed a phased implementation of practices.

Several other assumptions further contribute to a bias toward higher estimates of total cost. Staff assumed independence among the investments made in each management practice category, discounting the likely effect that an investment in one category, would reduce the need to invest in another. Staff expects this effect would be stronger in some categories than others. For example, investments in irrigation management have a strong potential to provide benefits to nutrient management by reducing nitrogen loading in tailwater and groundwater. Similarly, aquatic habitat protection could reduce the need for expenditures on practices to control sediment and stormwater, and to eliminate pesticide runoff. Without a way to quantify this overlapping of benefits among implementation practices (also described in Table 2), the total estimate likely exaggerates actual expenditures.

Table 7: Estimation of Cost to Implement Management Practices

Management Practice Category	Area Basis (Acres)	Acres/ Operation	Acres	Correction Factor	Acres Practice Applied to:	Cost/Acre [d]	Cost Year 1	% Year 1 Cost in Yrs 2-4	Cost Years 2-4	Cost 5 Years
Sediment / Erosion Control & Stormwater Management	Total irrigated farm acreage[a]	NA	539,284	5%	26,964	$992	$26,748,486	25%	$26,748,486	$53,496,973
Irrigation Management	Operations with tailwater[b]	NA	74,121	50%	37,061	$903	$33,465,632	10%	$13,386,253	$46,851,884
Nutrient & Salt Management	Total Vegetable Crop acreage[c]	NA	444,443	20%	88,889	$56	$4,977,762	25%	$4,977,762	$9,955,523
Pesticide Runoff / Toxicity Elimination	102 Operations on toxicity impaired streams	20	2,040	50%	1,020	$72	$73,440	50%	$146,880	$220,320
Aquatic Habitat Protection	10 Large Operations on temp. & turbidity impaired streams	1,000	10,000	50%	5,000	$1,184	$5,920,000	10%	$2,368,000	$8,288,000
						One Year	**$71,185,320**		**Five Years**	**$118,812,700**
						Per Operation	**$23,728**		**Per Operation**	**$39,604**

[a] State Farmland Mapping Program (FMMP) data consists of farmland classifications that include Prime Farmland, Farmland of Statewide Importance, Unique Farmland, and Farmland of Local Importance.

[c] Total Vegetable Crop acreage from County Crop Reports, Table 12. Staff assumed these crops have high potential to discharge nitrogen to groundwater.

[b] Amount of irrigated acreage that has tailwater and is enrolled and active. Source: Central Coast Regional Water Quality Control Board Agricultural Regulatory Program Database, December 2009. While the number of operations is dynamic, staff has not made a broad effort to verify the accuracy of reported irrigated acreage and tailwater acreage. Growers can continually update their irrigated acreage and tailwater acreage to reflect seasonal growing changes. The Water Board officially requested acreage updates in 2007 and 2008.

[d] Median of high end of cost range/acre, or, unit cost/acre, whichever is higher from Table 5.

2.2.3 Cost of Aquatic Habitat Protection Using Buffers

The following discussion of costs associated with Draft Ag Order requirements for aquatic habitat protection is provided to examine whether there is potential for these costs to affect regional and/or county economies. This discussion is presented separate from the previous discussion of aquatic habitat management practices available to individual growers and farm operations (2.2.2 Costs of Implementing Management Practices).

While implementation of a waterbody buffer is an option available to individual growers to achieve habitat management objectives, staff does not know how many growers will select this option. As such, staff estimated potential costs of buffers only for grower operations that are specifically required to implement them in the Draft Ag Order: those operations larger than 1,000 acres, and adjacent to a waterbody listed as impaired for temperature, sediment or turbidity on the Clean Water Act Section 303(d) List of Impaired Waters.

staff recognizes that buffers provide benefits that can be met through other means, but anticipates that buffers could be selected by growers as the most effective means for maintaining the riparian functions such as, stream bank stabilization and erosion control; stream shading and temperature control; chemical and sediment filtration; flood water storage; aquatic life support; and wildlife support. The greatest potential benefit to the grower of implementing a buffer could be the avoided cost of implementing other potentially more expensive water quality management practices to maintain these functions.

To serve as a basis for considering local and regional economic effects from implementing habitat buffers, staff prepared a spatial analysis of potentially affected farmland and made assumptions regarding the productivity and value of those lands. Staff purposely made conservative assumptions in calculating the approximate scale of anticipated effects, and considers the resulting cost estimate to be considerably higher than is reasonably likely to occur.

2.2.3.1 Spatial Analysis to Support Cost Analysis

Staff estimated the amount of irrigated agricultural land that would be removed from production in order to establish 30- and 50-foot wide habitat buffers. Only lands in operations greater than 1,000 acres and adjacent to waterbodies impaired by temperature, sediment or turbidity were included. Staff selected operations over 1,000 acres using the GIS crop maps distributed by the Agriculture Commissioner's Office in each Central Coast county (excluding San Benito and Ventura Counties). These maps are updated every two years within each county. For the identification of impaired waterbodies, staff used a 2008 version of the 2006 Clean Water Act Section 303(d) List of Impaired Waters spatial data file maintained by the Central Coast Ambient Monitoring Program.

Of all operations with 1,000 acres or more, the analysis identified only ten adjacent to waterbodies impaired for temperature, sediment or turbidity (Table 8). For these operations, staff determined the acreage that would be included in 30-ft and 50-ft buffers.

Table 8: Acreage Potentially Affected by Buffers on Waterbodies Impaired by Sediment [a]

County	Grower Operation	Total Acres	Acres in 30-ft buffer	Acres in 50-ft buffer
Monterey	1	4,017	12.54	43.00
	2	2,164	21.60	37.00
	3	1,329	7.70	27.00
	4	3,879	0.20	0.20
	5	1,020	0.06	0.13
	6	10,619	8.95	30.00
	7	1,132	4.80	17.00
	Subtotal	***24,160***	***56***	***154***
San Luis Obispo	1	1,274	8.12	14.00
	Subtotal	***1,274***	***8***	***14***
Santa Barbara	1	7,331	18.52	65.00
	2	1,490	0.10	0.30
	Subtotal	***8,821***	***19***	***65***
	TOTALS	**34,255**	**83**	**234**

[a] Includes only operations > 1,000 acres in size and adjacent to or including waterbodies listed for temperature, sediment or turbidity on the 2006 Clean Water Act Section 303(d) List of Impaired Waterbodies.

2.2.3.1.1 Crop Report Gross Value Analysis

To assess the potential economic effects of establishing buffers, staff calculated an approximate value of current agricultural productivity from farmlands. Staff compiled county crop report information on crop value and acreage to estimate average gross values per acre of crops requiring irrigation (Table 9). The resulting average crop value per acre ranges from $5,739/ac in San Benito County, to $22,047/ac in Santa Cruz County. This broad range reflects the variation in both crop types and crop values grown throughout the Central Coast. The regional average crop value per acre is $9,387/ac.

2.2.3.1.1.1 Potential Loss in Gross Production and Acreage

Based on the estimated acres of farmland included in buffers (Table 8), and average crop value (Table 9), staff estimated potential loss in production that would result from implementing 30- and 50-ft habitat protection buffers (Table 10). A range of approximately $774K to $2.2M of gross value would be lost to riparian buffers region-wide, based on this analysis. This represents approximately 0.24% to 0.68% of total crop value in the operations affected. Lost income to an individual grower, while not known, is a fraction of gross value lost, since the grower avoids costs of farming areas no longer in production.

2.2.3.2 Factors to Consider Relative to Buffer Cost Estimates

There are several factors to consider when reviewing these estimates of economic effects of implementing buffers on irrigated farm operations. However, for larger operations loss of crop productivity in the range of 0.21% – 1.1% could be less than losses to smaller operations implementing buffers, with a larger proportion of the entire operation dedicated to the buffer. The use of buffers could also result in avoided costs for other potentially high cost methods to achieve farm water quality management objectives, including, for example, tailwater treatment and sedimentation control facilities.

As stated above, staff considers these estimates to be higher than the economic effects that may actually occur. This is because of several conservative assumptions made in constructing the analysis, including:

- ***Size of Buffer:*** The buffer dimension of 50 feet used in the analysis is potentially larger than what is necessary to protect and maintain beneficial uses affected by discharges from irrigated agriculture. Buffers of smaller dimensions would reduce the effect on losses in acreage and productivity.
- ***Uniform Implementation:*** staff does not anticipate that buffers would be established in all 1,000-acre plus operations adjacent to impaired waterbodies. Staff expects that some growers will pursue alternatives to buffers on portions of riparian-adjacent farmland that provide comparable protection, restoration and maintenance of beneficial uses.
- ***Current Productivity of Farmland Adjacent to Waterbodies:*** The analysis assumed that all waterbody-adjacent farmland is currently productive at the average rate for the county in which they are located. This is not the case and there can be many reasons for this, including: land in poor agronomic condition; land impacted by geomorphologic factors (e.g., bank failure, channel migration, overbank sediment deposits, floodplain saturation); flood-related crop loss. These conditions are among those taken into consideration when growers establish the limits of cultivation. Consequently, some lands are currently in riparian or semi-riparian conditions by default, while others are uncultivated and/or entirely de-vegetated, serving as food safety setbacks. Either way, the land is not in production, as was assumed in the analysis. Dedicating low or non-productive lands to riparian buffers would have no near-term effect on individual farm or regional agricultural productivity.
- ***No Change to Price-Output Equilibrium:*** Lower productivity, (i.e., output, supply), even reductions as low as one to two percent, interacts with market demand to influence the price-output equilibrium for agricultural products. As such, the value per unit of output would be expected to increase as the market compensates for reduced supply. While staff made no attempt to model the change in value – and anticipates a relatively minor overall impact – the effect would be to reduce the

estimated loss in productivity, as expressed in the value per acre figures used in the analysis.

Other areas of uncertainty in the analysis may either overstate or understate the estimated effect. These include specific attributes of the data staff relied upon, including the accuracy of county crop reporting, and Staff's aggregation of those data.

A final factor to consider is that implementation of waterbody buffers would not happen immediately and/or simultaneously throughout the region. The more probable phasing of buffer implementation over a period of years would be expected to significantly lessen economic effects as market forces and changes in farming operations play out. On the other hand, the effect would be recurring, or at least continue beyond a single year, in that some riparian lands with agricultural production potential would be permanently removed from production.

Table 9: Estimated Average Gross Value per Acre of Select Crops, by County (2009)[4]

County	Vegetable Crops			Fruit & Nuts			Seed Crops			Total Irrigated Crops		
	Value (Millions)	Acres	Average $/Ac	Value (Millions)	Acres	Average $/Ac	Value (Millions)	Acres	Average $/Ac	Value	Acres	Average $/Ac
Santa Cruz	$47	7,431	$6,322	$317	9,074	$34,925				$364M	16,505	$22,047
San Luis Obispo	$187	31,926	$5,867	$271	46,034	$5,897				$459M	77,960	$5,885
Monterey	$2,632	314,311	$8,373	$1,043	55,095	$18,925	$9	4,995	$1,863	$3.7 B	374,401	$9,839
Santa Barbara	$469	65,775	$7,135	$547	39,963	$13,698	$10	2,199	$4,701	$1.0 B	107,937	$9,515
San Benito	$157	25,000	$6,262	$31	7,641	$4,029				$187M	32,641	$5,739
TOTAL	$3,492	444,443	$7,857	$2,209	157,807	$14,000	$20	7,194	$2,730	$5.7 Billion	609,444	$9,387

Table 10: Calculated Loss in Gross Production Value and Crop Acreage for Habitat Buffers [a]

County	Avg. Crop Value per Acre*	Total Operation Acres	Total Operation Crop Value	Acres and Value Loss to 30' Buffer			Acres and Value Loss to 50 'Buffer		
				Acres	Gross Value	% of Total Operation Crop Value*	Acres	Gross Value	% of Total Operation Crop Value*
Monterey	$9,839	24,160	$237,710,240	56	$549,508	0.23%	154	$1,518,453	0.64%
San Luis Obispo	$5,885	1,274	$7,497,490	8	$47,786	0.64%	14	$82,390	1.10%
Santa Barbara	$9,515	8,821	$83,931,815	19	$177,169	0.21%	65	$621,330	0.74%
Total Operation Loss to Buffers		**34,255**	**$329,139,545**	**83**	**$774,464**	**0.24%**	**234**	**$2,222,172**	**0.68%**

[a] For operations 1,000 acres or larger and adjacent to or including waterbodies impaired for temperature, sediment or turbidity (See Table 8).

* Vegetable, Fruit & Nut, and Seed Crops only (see Table 9).

[4] All figures for 2009 with the exception of San Benito County for which staff used 2008 crop reports, since 2009 crop report was unavailable when calculated.

2.2.4 Monitoring Program Costs

Staff price estimates for MRP analytical costs come from several commercial laboratory bids to the Central Coast Ambient Monitoring Program (CCAMP) and Surface Water Ambient Monitoring Program contractor costs. Anywhere from two to four prices per analyte were used to develop average costs. Water quality lab bids included BC Analytical, Creek Environmental Lab (no longer in business), Sequoia Labs, Surface Water Ambient Monitoring Program (SWAMP) and Groundwater Ambient Monitoring and Assessment Program (GAMA). Pyrethroid pesticide analysis costs came from SWAMP and CalTest, a private water quality lab. Bioassessment pricing came from Pacific Ecorisk and SWAMP. Actual prices charged to a cooperative monitoring program or individual may vary from these estimates. Attachment 1 includes monitoring cost information tables supporting the following discussion of receiving water, groundwater, and individual monitoring.

2.2.4.1 Receiving Water Monitoring

The receiving water monitoring program has estimated analytical costs ranging from about $600,000 to $785,000, depending on site count. The current cooperative monitoring program requires 50 sites (plus five percent field duplicates). The proposed program requires at least one site on each of 37 impaired waterbodies. The price range reflects this site count spread. The proposed MRP includes the basic trend component of the current program. In addition, it adds several analytes to the basic monitoring suite, water and sediment chemistry in the second year of the program, and two stormwater samples taken at each trend site each winter. It adds quarterly and stormwater monitoring for pathogen indicators. It eliminates follow-up monitoring entirely (which in the original program was 20 percent of total program costs) and reduces benthic invertebrate monitoring down from annually to once per permit term.

In addition to analytical costs, the cooperative receiving water monitoring program must pay sampling costs, administrative costs, and reporting costs. Depending on how the program is structured these can range widely. For example, if sampling costs are charged on a per site basis, at $500 per site per visit, these costs could range up to $250,000 per year. However, if program staff conducts the sampling these costs could be significantly lower. The existing Cooperative Monitoring Program (CMP) maintains two full-time staff, which probably cost the program at least an additional $150,000 per year. Some of the reporting costs are absorbed by staff. Consulting laboratories may charge additional data management and analysis costs. Using the above estimates for consultant site visits costs and staffing costs, the total program costs would range between $1,000,000 and $1,185,000 per year (with higher costs for the second year averaged out through all years of the program), or $5 to $5.5 million for the five-year program.

Dropping site count from the 50 required by the current program down to one site per listed waterbody reduces receiving water monitoring costs by about 25 percent. As a result, some larger waterbodies like the Salinas River would have poor site coverage for understanding spatial extent of agricultural impacts. Though CCAMP monitoring can help address this, CCAMP watershed rotation monitoring only occurs once every five years.

The new elements of the program (pollutants in water and sediment, additional monthly parameters, Toxicity Identification Evaluations (TIEs)) add approximately $130,000 to $148,000 per year in analytical costs (amortizing once in five year costs over each of the five years of the program). This is assuming 10 TIEs are conducted per year. If no TIEs are conducted, additional monitoring costs are approximately $76,000 to $97,000 per year. These costs are offset by elimination of follow-up monitoring, reduction of benthic invertebrate monitoring to once per permit term, and any site count reductions.

2.2.4.2 Groundwater Monitoring

Tier 1 and Tier 2 analytical cost estimates for groundwater monitoring described in the MRP are approximately $190 per well for the five-year program (with both sampling events in the first year), using cost estimates from the GAMA program. Tier 3 analytical costs are approximately $760 per well for the five-year program (four times in the first year; annually thereafter for a total of eight sampling events). This does not include costs paid to consultants to collect the samples, assess depth to groundwater and deliver the results. Staff estimates these additional costs at approximately $300 per visit. Staff assumes that there are 1,600 dischargers that fall into Tiers 1 and 2 and another 100 that fall into Tier 3. Based on these numbers and a consultant visit fee of $500 (with a discounted rate of $150 for sampling a second well), and assuming one well sampled for Tiers 1 and 2, and two wells sampled for Tier 3, this program element would cost approximately $1,740,000, or $790 for Tier 1 & 2 growers and $4,740 for Tier 3 growers, for the five-year term of the Draft Ag Order.

2.2.4.3 Individual Monitoring

Tier 1 and 2 does not require any surface water quality monitoring. Tier 3 individual monitoring is further subdivided into operations between 1,000 and 5,000 acres, and operations over 5,000 acres. Staff estimates that analytical costs will be approximately $3,150 per site sampled for smaller operations (1,000 to 5,000 acres) and $6,300 for larger operations (>5,000 acres). Most of this cost is from toxicity sampling. In addition, for each site sampled, flow and field parameters are collected, which may cost between $500 and $750 each visit. This brings the annual cost to between $4,100 and $4,600 for smaller Tier 3 operations and between $8,200 and $9,300 for larger operations.

Tier 3 tailwater pond monitoring can be done using United States Environmental Protection Agency approved field methodologies or a commercial laboratory. Commercial laboratory analysis costs are estimated at $180/year (4 irrigation season, 2 wet season samples). If a consultant is required to visit the pond for each of the six sampling events, at $500 - $750/event, that could add $3,000 to $4,500 to annual costs.

Staff estimate that there are approximately 85 dischargers that fall into the 1,000 – 5,000 acre Tier 3 category, and 15 falling into the >5000 category. Total cost of implementing this monitoring element is approximately $500,000 per year, or $2.5 million for the five-year program. This does not include additional costs for tailwater pond monitoring. Staff does not currently have an estimate of how many tailwater ponds would fall into the Tier 3 category.

2.2.4.4 Quality Assurance Project Plan (QAPP)

QAPP development for a large complex project can cost up to $10,000. If templates with all language for basic individual sampling except for some minor details are prepared and made available, costs could be vastly reduced. Staff estimates these documents could be prepared for $750 or less for individual and/or groundwater monitoring, assuming a ready-to-use QAPP template is available for use. This should be a one-time cost for the term of the program.

2.2.4.5 Photo-Monitoring

To serve as a basis for estimating costs of habitat buffer photo-monitoring, staff prepared a spatial analysis to estimate the amount of irrigated agricultural land that exists adjacent to streams. Staff selected all streams included in National Hydrographic Data-Plus data and “clipped” the adjacent 50 feet of land identified in California Department of Conservation, Farmland Mapping and Monitoring Program (FMMP) land use data. The result provides an estimate of the amount of irrigated farmland that occurs within 50 feet of a stream throughout the Central Coast Region.

The FMMP data consists of farmland classifications that include Prime Farmland, Farmland of Statewide Importance, Unique Farmland, and Farmland of Local Importance. Prime Farmland and Farmland of Statewide Importance are irrigated lands with good combination of physical and chemical characteristics for the production of agricultural crops. Unique Farmland has lesser quality soils and is usually irrigated, but may include non-irrigated orchards or vineyards as found in some climatic zones in California. Generally for land to be included in these categories it must have been cropped at some time during the four years prior to the mapping date.

Staff excluded Farmland of Local Importance from the analysis, since these are designated by counties and are generally non-irrigated lands. Specific criteria used by the counties to classify these farmlands support their exclusion from the analysis (Table 11).

Table 11: County Farmland Designations Not Included in Buffer Analysis

County	Designation Criteria for Farmland of Local Importance
Monterey	The Board of Supervisors determined that there will be no Farmland of Local Importance for Monterey County.
San Benito	Land cultivated as dry cropland. Usual crops are wheat, barley, oats, safflower, and grain hay. Also, orchards affected by boron.
San Luis Obispo	Farmland of Local Importance: areas of soils that meet all the characteristics of Prime or Statewide, with the exception of irrigation. Local Potential: lands having the potential for farmland, which have Prime or Statewide characteristics and are not cultivated.
Santa Barbara	All dryland farming areas and permanent pasture (if the soils were not eligible for either Prime or Statewide).
Santa Clara	Small orchards and vineyards primarily in the foothill areas. Also land cultivated as dry cropland for grains and hay.
Santa Cruz	Soils used for Christmas tree farms and nurseries, and that do not meet the definition for Prime, Statewide, or Unique.

Source: "Farmland of Local Importance" http://www.conservation.ca.gov/dlrp/fmmp/Documents/Local_definitions_00.pdf

Table 12 presents the results of the spatial analysis to quantify farmland within 50 feet of a stream. Based on this analysis, Monterey County has approximately 877 acres and the entire Region has approximately 2,373 acres of irrigated farmland within 50 feet of a stream. The majority of this land is classified by the FMMP as prime farmland.

Table 12: Estimated Farmland Within 50 feet of a Waterbody

COUNTY	FARMLAND TYPE	Acres within 50-ft of Stream
		Total
Santa Cruz	Prime Farmland	140
	Farmland of Statewide Importance	2
	Unique Farmland	25
		166
San Luis Obispo	Prime Farmland	292
	Farmland of Statewide Importance	57
	Unique Farmland	158
		507
Monterey	Prime Farmland	550
	Farmland of Statewide Importance	92
	Unique Farmland	235
		877
Santa Barbara	Prime Farmland	181
	Farmland of Statewide Importance	40
	Unique Farmland	111
		332
San Benito	Prime Farmland	73
	Farmland of Statewide Importance	37
	Unique Farmland	155
		265

Santa Clara	Prime Farmland	113
	Farmland of Statewide Importance	26
	Unique Farmland	85
		224
San Mateo	Unique Farmland	1
	TOTAL	**2,373**

Within one year of the adoption of the Draft Ag Order or enrollment, Tier 2 and Tier 3 dischargers that have operations that contain or are adjacent to a waterbody impaired for temperature or turbidity must conduct photo monitoring to document the condition of perennial, intermittent or ephemeral streams (wet or dry), riparian or wetland area habitat, and associated management practices implemented to prevent waste discharge and protect water quality. Photo monitoring must be repeated every three years.

Staff estimated that large (greater than 1,000 acres) operations on temperature or turbidity impaired waterbodies had approximately 234 acres within 50 feet of the waterbodies (see analysis of habitat buffer costs). This is close to ten percent of the total acreage of riparian farmland. Absent information on which Tier an operation will be in, staff took the median of the two acreage figures as a conservatively high estimate of the total number of acres subject to the Draft Ag Order requirement that Tier 2 and Tier 3 dischargers in operations on waterbodies impaired for temperature or turbidity must conduct photo monitoring.

Total farm acres within 50 feet of a waterbody	***2,373***
Total farm acres within 50 feet of a waterbody in large operations on temperature and turbidity impaired waterbodies	***234***
MEDIAN	***1,304***

Using the median of 1,304 acres, staff then calculated the linear distance of riparian farmland to be 1,135,460 feet. Assuming one photo point every 600 feet of linear stream buffer length, a total of 1,893 photo points would be established on farm areas subject to this Draft Ag Order requirement.

Based on a median operation size of 20 acres, approximately 65 operations would be affected by this requirement. Each operation could incur approximately $155 in one-time costs for a camera ($140), compass ($10), farm map ($3), and notebook ($2). Assuming a cost of $27 per photo point ($2.00 to copy photos and $25/hour/photopoint), and two photo monitoring events for the 5-year term of the Order, staff estimates the total cost of complying with this monitoring requirement to be approximately $112,280 (Table 13).

Table 13: Cost Calculation for Photo Monitoring Requirement

Acres	Square Feet = (ac) x (43,560 sq ft/ac)	Stream Length = Sq ft/50 ft width	1 Photo Point/600 ft	Per Point Cost ($54)	One-time Cost ($155)	Total
1,304	56,780,460	1,135,609	1,893	$102,205	$10,075	$112,280

2.3 Cost to Water Board for Program Administration

The cost for the Central Coast Water Board to implement the Agricultural Regulatory Program is incurred primarily to pay for employees' time conducting program activities. Staff in the program generally evaluates compliance and progress by reviewing water quality data, evaluating chemical use, inspecting farms and ranches, conducting outreach and taking enforcement actions.

With the current staffing and budget, staff cannot review information from, nor inspect, most of the operations in the region. Staff prioritizes efforts in watersheds and areas with most severe water quality problems, and focuses on individual farms or ranches that are or may be discharging in violation of water quality laws to determine the amount of outreach and enforcement.

With the Draft Ag Order, staff plans to implement at the same level of resources but expects to gain efficiencies in encouraging and tracking progress and responding with enforcement as needed. Staff will be able to prioritize more effectively by relying on both watershed-scale water quality data and refined and increased reporting. The Draft Ag Order requires basic information from all operations that better indicates water quality threats (such as pesticide use and proximity of applications to waterbodies). Additional reporting information will vary for different tiers of operations based on an operation's threat to water quality and proximity to impaired waterbodies. The highest threat tiers must submit the most information and the lowest threat tiers must submit more limited information. Additionally, staff plans to rely on new and enhanced databases to collect and manage data and information so that the increased volume of information and data can be reviewed, organized and analyzed more efficiently. Staff estimates the cost of program implementation based on the annual cost of each staff position and the numbers of staff positions needed to be approximately $882,375 (Table 14).

Table 14: Water Board Staff Annual Cost to Administer Program[5]

Classification	Cost/position	Positions	Total Cost
Environmental Scientist	$123,360	2.5	**$308,400**
Senior Environmental Scientist	$142,080	0.2	**$28,416**
Environmental Program Manager	$163,620	0.4	**$65,449**
Engineering Geologist	$181,920	0.5	**$90,960**
Senior Engineering Geologist	$193,644	0.5	**$96,822**
Supervisory Engineering Geologist	$212,592	0.2	**$42,518**
Water Resource Control Engineer	$180,984	1.0	**$180,984**
Supervisory Water Resource Control Engineer	$212,592	0.2	**$42,518**
Office Technician, Typing	$70,500	0.2	**$14,100**
Office Assistant, Typing	$61,044	0.2	**$12,208**
All Positions:			**$882,375**

[5] Costs include total cost to State for all expenditures (salary, benefits, etc.).

3 EFFECTS OF INCREASED COSTS ON FARM AND REGIONAL ECONOMY

3.1 Introduction

California's agricultural industry is characterized by a variety of economic conditions that have permitted its expansive growth over the last century – most notably continued population growth contributing consumers of produce and the ability to market produce to consumers worldwide. Numerous studies describe the favorable economic conditions for the agricultural sector, while others caution that in the future growers will have to be increasingly flexible, adaptive and innovative to survive as they confront water scarcity, pressures of a globalizing agricultural economy, and less favorable government crop price support policies.[6] Water quality regulations are also among the factors challenging the industry to adapt.

In this Technical Memorandum the costs for dischargers to achieve compliance with the Draft Ag Order are considered in terms of expenses for management practice implementation, monitoring, and reporting. These expenses combine with other factors, such as increased energy costs and the challenges described above, to incrementally increase the discharger's cost of production. Examining the impact of any increase in cost of production on viability of a farming enterprise is challenging. The fact is that changes in costs of production are one of many factors affecting viability and the interaction of these factors is highly dynamic through time.

3.2 Strawberries: An Example of Multiple Factors Affecting Farm Economy

The anticipated effects of increased costs of production resulting from a ban on methyl bromide[7] in strawberry cultivation, illustrate how many of these factors can affect outcomes for growers. Strawberries are a particularly high value crop and are not necessarily representative of agriculture throughout the Central Coast. Nevertheless, the research on strawberries is particularly germane to the Central Coast Region where strawberries contribute a substantial amount (more than $1.4 billion farm gate value in 2009) to the region's overall agricultural productivity. The region also accounts for more than 50 percent of total United State's strawberry production.[8] (California contributes approximately 90 percent of the nation's strawberries.[9]) Research on the potential costs of the ban[10] is presented here because it specifically addresses how several of

[6] Vaux, Henry J. Jr., 1996. "Future trends challenge irrigated agriculture." California Agriculture, Volume 51, Number 1. p. 2.

[7] Methyl bromide is a toxic chemical pesticide that depletes the earth's protective ozone layer but which also serves as a soil-sterilizing agent for farmers. Strawberry farmers are among users fearing significant losses and even farm failures without the continued availability of methyl bromide as a fumigant.

[8] Mark Murai, President, California Strawberry Commission. April 1, 2010-Letter to Water Board Chair Jeffry Young for May 12, 2010 Workshop on Preliminary Draft Ag Order.

[9] Starrs, Paul F., and Peter Goin, 2010. Field Guide to California Agriculture. U.C. Press.

[10] The Montreal Protocol on Substances that Deplete the Ozone Layer has been the most successful international environmental agreement ever reached (Norman, et al, 2005). While methyl bromide is

the factors that influence the viability of producing any agricultural commodity in the Central Coast interact, including: cost of environmental compliance; costs of production; characteristics of price response in the market; and the effects of globalization (as manifested in competition from Mexican growers).

Researchers[11] found that estimates of economic loss attributable to the new regulation banning methyl bromide "incorporate losses from lower yields, lower quality fruit, and higher production costs. The high end of the estimate translates to between 20 and 57% of net returns above operating costs for a typical grower... These estimates are alarming to farmers but they do not account for important market effects that will reduce the burden borne by farmers even without any transitional assistance."

In regards to the market response to increased costs of production, the researchers observe that, "A cost increase to producers is reflected in an upward (leftward) shift of the long-term supply curve by an amount equal to the cost increase, as farmers require higher prices to produce any given quantity of strawberries. This interacts with market demand to determine a new price-output equilibrium." The researchers then state that, "demand at every price is increasing, because of income and population growth effects… at a rate estimated at 2.3% annually. [This] effect dominates, suggesting that farmers will not face losses at all but simply a slowing of the rate of increase in the gains that they would have expected in the absence of a cost increase." The current conditions of stagnating income growth are different from 2005 when this research was completed. Nevertheless, the ban on methyl bromide is not implicated in declines in strawberry production.

Finally, with respect to the pressures of globalization and the potential for a competitive advantage by Mexican strawberry growers, these economists state:

> "In the long term, all else held constant, on the margin some increase in imported berries from Mexico can be expected if U.S. prices rise in response to a possible cost increase as methyl bromide is phased out in the U.S. while use is still allowed in Mexico. However, capacity to produce for export in Mexico would have to grow dramatically at a rate without historical precedent for imports to make a serious dent in the U.S. market even then."
>
> "In the last 10 years, Mexican strawberry exports to the U.S. have quadrupled. If they quadruple again in the next 10 years and if the U.S. market does not grow at all…Mexican imports would then be 24% of U.S. consumption. The majority of the market would still be supplied by domestic producers, and given relatively

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only one of many substances being phased out under the Protocol, it has so far been the most controversial.

[11] Norman, Catherine S. 2005. ***Potential impacts of imposing methyl bromide phaseout on US strawberry growers: a case study of a nomination for a critical use exemption under the Montreal Protocol***. Journal of Environmental Management 75 (2005) 167-176.

> inelastic demand, cost increases to U.S. growers would be passed through to consumers to a significant degree."

More recent information on strawberry market conditions from USDA further illustrates the diversity of influences affecting market conditions and, by extension, the ultimate viability of agricultural enterprises. The USDA Economic Research Service May 2010[12] outlook reports:

> "Strawberry retail prices experienced the biggest decline in April, falling 10 percent to $1.667 per 12-ounce (oz) pint from the April 2009 price. Retailers were faced with an abundance of strawberries as Florida supplies, while slow to recover from the late-January freeze, soared at the tail end of their shipping season and were competing with early-season supplies from California. Last year the same time, Florida supplies were already winding down. In California, wet and cold weather has interrupted production sporadically this spring but seasonal supply increases are occurring. Production is forecast to be down in California this year, likely putting upward pressure on strawberry prices this summer relative to last."

> "A decline in strawberry supplies in the U.S. market this year may be attributed mostly to smaller crops in two of the biggest producing States—California and Florida. The initial forecast from USDA's National Agricultural Statistics Service (NASS) calls for a 7-percent decline in strawberry production in California in 2010 from a year ago, reaching 2.3 billion pounds. A distant second to California, the winter strawberry crop in Florida was forecast down to 144.0 million pounds, declining by 39 percent. Both strawberry harvested acres and the average yield per acre in California are forecast to be reduced compared to last year, driving down production this year. Intermittent rainy weather caused by an El Nino weather pattern disrupted shipments early in the season as field workers had to alternate between picking and stripping the fields. Current projections are for harvested acreage in 2010 to decline 6 percent from 2009, reaching 37,500 acres (fig. 3). NASS also forecast average yields to be down 2 percent this year to 61,500 pounds per acre."

The strawberry example illustrates the relative influence of multiple factors in determining the ultimate economic viability of farming enterprises, and places in context the incremental increased costs of production attributable to environmental compliance. As the USDA outlook report shows, factors such as weather and the timing of production in Florida appear to dominate the near term economic conditions for the fresh market in strawberries.

3.2.1 Price Elasticity

[12] USDA, Economic Research Service, 2010. "Fruit and Tree Nuts Outlook: California's Strawberry and Peach Crops Smaller but Almond Production Up." May 28.

The market for strawberries, like that of most agricultural commodities, is characterized by relatively inelastic demand. One measure of this, ***own price elasticity*** – a measure that indicates the extent to which consumption is sensitive to price – is calculated as the percentage change in quantity demanded of a good or service divided by the percentage change in its price, other factors remaining unchanged. The higher the price elasticity, the more sensitive consumers are to price changes. Very high price elasticity suggests that when the price of a good goes up, consumers will buy much less of it and when the price goes down, they will buy much more. Very low price elasticity (or, inelasticity) implies just the opposite, that changes in price have little influence on demand. If elasticity is greater than one, demand is said to be elastic; between zero and one demand is inelastic. Realistically, elasticity is best considered in relative terms, since the greater than/less than one boundary is not a bright line, i.e., calculations of elasticity are generally more reliable the farther they are from the number one.

For strawberries, the mean own-price elasticity reported by the United States Department of Agriculture's Economic Research Service is -0.92826.[13] This means that a one percent increase in price would give a 0.92 percent decrease in quantity demanded. Conversely, a one percent decrease in quantity would give a 1.08 percent increase in price. Own price elasticities for lettuce, broccoli, grapes and celery are presented in Table 15. According to these data, among these major regional crops, only grapes and broccoli have relatively elastic demand.

Several factors affect elasticity of demand for a good, including, for example, availability of substitute goods, necessity, and brand loyalty. The primary determinant of agricultural commodity elasticity is likely necessity: the more necessary a good, the lower the elasticity, since consumers will attempt to buy it no matter the price.

[13] USDA Economic Research Service, 2010. Data Sets. "Commodity and Food Elasticities: Demand Elasticities from Literature Results."
http://www.ers.usda.gov/Data/Elasticities/ShowTable.aspx?geo=United%20States&com=Strawberry

Table 15: Own Price Elasticity of Several Crops in the Central Coast Region

Crop	Own Price Elasticity[a]						
							Average
Strawberries	0.449	0.438	2.398	1.957	0.2753		0.92826
Lettuce	0.131	0.0139					0.07245
Bagged Lettuce	[b]						0.56023
Broccoli	1.048	1.043					1.0455
Onion	0.11	0.289	0.1964	0.1832			0.19465
Grapes	1.468	2.092	1.378	1.5	1.168	0.9075	1.41892
Celery	0.2516	0.0501					0.15085
Fruit and Vegetable	0.45	0.06986					0.25993
Vegetables	[b]						0.68613

Source: USDA Economic Research Service

a) Expressed in terms of absolute value.

b) Individual elasticities too numerous to list in table (see source).

3.2.1.1 The Significance of Price Elasticity on Total Revenue

When increases in costs of production are passed on to consumers as higher prices, elasticity is important in determining the affect this will have on total revenues for the commodity producer. Due to the fact that most agricultural commodities are characterized by relatively inelastic demand (<1), the following relationship between price elasticity and total revenue holds: the percentage change in quantity demanded is smaller than the percentage change in price. So, when prices go up, total revenue rises, and vice versa. Where the price elasticity of demand is relatively elastic, the percentage change in quantity demanded is greater than the percentage change in price, so total revenue falls.

The relatively inelastic nature of demand for most agricultural products means that consumers share the costs of production by paying higher prices, and that the effect on total revenue of increased costs of production is substantially attenuated.

3.2.2 Effects of Increased Costs on Regional Economy

To further characterize the potential effects of implementing the 2011 Draft Ag Order on the regional economy, staff evaluated data on Monterey County's agricultural output, employment and income. At $3.7 billion, Monterey County's agricultural production is three times that of Santa Barbara, the county nearest in production; and it is more than all the other Central Coast counties combined (Table 16). Given the County's dominant role in the region with respect to the agricultural sector, and the limitations in obtaining comparable information from the region's other counties, staff presents the Monterey County data to convey the magnitude of potential effects of the Draft Ag Order region-wide.

Table 16: Central Coast Counties Total Agricultural Production from Crop Reports[14]

County	Production
Monterey	$3,683,754,000
Santa Barbara	$1,027,047,467
San Luis Obispo	$458,783,000
Santa Cruz	$363,888,000
Santa Clara	$247,950,400
San Benito	$187,334,000

A 2004 report completed for the County evaluated output, employment, and income in the agricultural sector based on a popular economic model for which the principal input was total agricultural production.[15] The report put agriculture production in the County at about $2.9 billion, and the model estimated total economic impact to be approximately $5.2 billion (Table 17). The total economic impact included the sum of all direct, indirect, and induced economic activity associated with agricultural production. The indirect industry output is the economic value of the supplier relationships needed to support the production sector. The $5.2 billion figure also includes $788 million of induced output from household spending. The report also cites economic studies that indicate the added economic activity associated with food processing doubles the total economic benefit of the agriculture industry cluster in Monterey County to more than $10 billion.

Table 17: Baseline Economic Agricultural Production, Monterey County 2001

Baseline Monterey County Agriculture	Direct	Indirect	Induced	Total
Industry Output	$2,891,741,245	$1,509,444,557	$788,242,109	$5,189,427,933
Labor Income	$657,575,605	$606,230,491	$301,479,428	$1,565,285,535
Employment (jobs)	26,371	30,434	9,579	66,384

Source: Applied Development Economics, 2004. Table 2-7, p. 30.

The 2004 report examined the economic impact of the then proposed County General Plan. Included among the potential impacts of the General Plan was approximately 12,768 acres of agricultural land conversion to non-agricultural uses. The report assessed the degree to which these land conversions would reduce agricultural production in the County, and examined “the extent to which these direct impacts potentially affect other businesses that have existing buyer-supplier relationships with agricultural businesses or rely on household spending from agricultural workers,” (p. 43).

The nearly 12,800 acres of farmland projected for conversion in the General Plan comprised about $131 million of crop production, according to the report (p. 46). The resulting economic impact would total approximately $232 million, or less than five

[14] All figures for 2009 with the exception of San Benito and Santa Clara County for which staff used 2008 crop reports, since 2009 crop report was unavailable.
[15] Applied Development Economics, 2004. “Monterey County General Plan Update: Economic Impact Analysis.” February.

percent of total economic activity generated through agriculture (Table 18). Labor income impacts would be around $68 million, and approximately 3,100 jobs would be lost. These impacts would be expected to play out over the 20-year planning horizon of the General Plan.

Table 18: Economic Impact of General Plan Farmland Conversion, Monterey County 2001

Monterey County Agriculture	Baseline	General Plan Agricultural Acreage Reduction Impacts
Industry Output	$5,189,427,933	$231,637,351
Labor Income	$1,565,285,535	$67,655,440
Employment (jobs)	66,384	-3,126

Source: Applied Development Economics, 2004. Table 2-25, p. 46.

Staff finds the County's 2004 report to be valuable in illustrating the indirect effects of economic impacts to agriculture. The report's reliance on economic modeling that integrates multipliers to estimate these impacts is an appropriate and common practice. Given the significance of Monterey's agricultural economy in the Central Coast region overall (Table 16), the report's findings are generally helpful in characterizing impacts to agricultural productivity that could potentially result from implementation of the Draft Ag Order. As the report states:

> "The significance of the impacts of agricultural conversion can vary from one location within Monterey County to another, because different agricultural commodities have different economic value. Although even worst-case estimates of agricultural acreage conversion totals do not generate impacts that would potentially wipe out any of the crop categories…it is still important to examine the impacts that agricultural land conversions will potentially have…because these land conversions do not only affect farm production. A multitude of support services and local-serving businesses depend on spending from not only the agricultural businesses but their employees and their families as well." (pp. 40-41).

4 SOURCES OF FUNDING FOR IMPLEMENTATION

4.1 Summary of Funding Sources

A number of existing or potential funding sources may be available to offset portions of the cost of implementing the Draft Ag Order. These program descriptions were taken from an economic analysis conducted for the Central Valley Regional Water Quality Control Board.[29] Central Coast irrigated agricultural discharges would be subject to the same eligibility criteria and access to these sources of funding. The programs described are illustrative and are not intended to constitute a comprehensive list of funding sources.

4.1.1 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. Both of these programs provide financial and technical assistance for activities that improve water quality on agricultural lands. For example, the NRCS provides financial and technical assistance to growers to improve water quality.

The assistance is through the Agricultural Water Enhancement Program, an element of the NRCS EQIP. The program is a voluntary conservation initiative in which NRCS develops partnership agreements with eligible growers. Farm bills typically are in place for four to five years. Subsequent farm bills may expand, reduce, eliminate, or replace EQIP. Farm bills or other future legislation may authorize spending for direct grants, loans, or cost-sharing for irrigation practices that improve water quality.

4.1.2 State Water Resources Control Board

The Division of Financial Assistance administers water quality improvement programs for the State Water Board. The programs provide grant and loan funding to reduce non-point-source pollution discharge to surface waters. The 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 Agricultural Water Quality Grant Program provides funding to reduce or eliminate the discharge of non-point-source pollution from agricultural lands into surface and groundwater. It is currently 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 non-point source water quality control activities. The State Water Board also administers Clean Water Act funds that can be used for agricultural water quality improvements.

4.1.3 Safe, Clean, and Reliable Drinking Water Supply Act of 2010

This act was passed by the Legislature as SBX 7-2, and if approved by voters in November of 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. The actual amount and timing of funding availability will depend on its passage, on the issuance of bonds and the release of funds and on the kinds of programs and projects proposed and approved for funding.

4.1.4 Other Funding Programs

Other state and federal funding programs have been available in recent years to address agricultural water quality improvements. Integrated Regional Water Management grants were authorized and funded by Proposition 50 and now by

Proposition 84. These are being administered jointly by the State Water Board and DWR. Proposals can include agricultural water quality improvement projects. The Bureau of Reclamation also can provide assistance and cost-sharing for water conservation projects that help discharges.

4.2 Effect of External Funding on Economic Impacts

The following conclusion from the Central Valley economic study holds for this analysis as well:

> "Funding received from grants, cost-sharing, or low-interest loans would offset some of the local growers' expenditures for compliance and management practice implementation, and likely would reduce the losses in irrigated acreage and value of production described above. 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. Regional economic impacts also would be reduced."

5 COMPREHENSIVE COST CONSIDERATIONS

5.1 Costs of Implementation and Costs of Current Conditions

A comprehensive consideration of costs associated with the Draft Ag Order includes costs of current conditions, without implementation of the Draft Ag Order, and the costs of implementation of the Draft Ag Order. The costs associated with current conditions include, for example, environmental (beneficial use impacts) and public health impacts from contaminated drinking water sources. While these costs may be in part borne by dischargers, they fall principally on the public at-large, with greatest effects felt by the public living in agricultural areas. Though not a formal cost-benefit analysis[16], this Technical Memorandum provides information about costs associated with the Draft Ag Order and identifies sources of financing.

5.2 Full Costs of Agriculture as Currently Practiced

5.2.1 Financial Costs of Production

Environmental regulatory compliance is among the many financial costs borne by growers as primary inputs to production. Other financial costs include: labor, energy, water, equipment, land, agricultural chemicals and seed or nursery stock.

5.2.1.1 Public Sector Funding for Agriculture

[16] A formal cost benefit analysis is not required when issuing waste discharge requirements or a waiver of waste discharge requirements or when complying with CEQA. Benefits to society of agricultural production are nearly immeasurable. However, different forms of agricultural production provide food sources while having different costs and causing different watershed changes.

Federal and State programs supporting conservation practices (e.g., Natural Resources Conservation Service, Environmental Quality Incentives Program (EQIP)), water quality monitoring (Central Coast Water Board funding for cooperative monitoring program), and funding for non-point source pollution control (USEPA CWA Section 319(h)) are examples of agricultural production costs shared by the public sector.

Table 19 presents examples of public funding that supports Central Coast agriculture. These funds contribute to the continued profitability of agriculture by supporting the industry's investments in practices to increase production, while at the same time providing incentive to growers to address environmental impacts, including degraded water quality. In this sense, taxpayers share certain costs of production, including, at times, the costs of environmental protection.

Table 19: Example Public Sector Funding to Agriculture

Funding Type	Amount	Source
Water Board Administered Funding to Agriculture-related Projects, Region-wide	$14.4 Million Total 2005 – 2010	CCRWQCB
Federal EQIP Obligation Amount in Marine Sanctuary Counties	$1.6 - $2.6 Million Per year 2005 – 2009*	USDA[17]

* $18 million in Farm Bill funding was obligated to EQIP contracts in Marine Sanctuary Counties over ten years. Farmers have invested $15 million of their own money in match over the same period.

5.2.1.2 Public Health and Environmental Financial Impacts of Discharges of Waste Associated with Agriculture (Externalities)

Discharges of waste associated with agricultural activities result in impacts on public health and the environment, including impacts related to environmental justice issues. Those impacts result in costs to the public and the environment rather than the discharger of the waste that are not typically considered in evaluating costs.

This Technical Memorandum includes information about some social and environmental costs associated with irrigated agriculture in the Central Coast that staff would expect to be reduced over time with implementation of the Draft Ag Order.

5.2.2 Social Costs of Current Conditions

Costs to the public associated with discharges of waste from irrigated agriculture in the Central Coast Region can be discussed in three broad categories: Public Health, Environmental Health, and Environmental Justice.

5.2.2.1 Public Health

Thousands of people in the agricultural areas of the Central Coast Region rely on public supply wells and shallow private domestic wells with unsafe levels of nitrate and other

[17] Mountjoy, Daniel, USDA, NRCS. Salinas, CA. October 2009 Presentation on 10-Year Anniversary of Agriculture and Rural Lands Program.

waste constituents. Excessive nitrate concentration in drinking water is a significant public health issue resulting in increased health risk to infants and adults. While acute health effects from excessive nitrate levels in drinking water are primarily limited to infants (methemoglobinemia or "blue baby syndrome"), evidence suggests there may also be adverse health effects among adults as a result of long-term ingestion exposure, and in older individuals who have genetically impaired enzyme systems. These effects include: increased risk of non-Hodgkin's lymphoma, diabetes, Parkinson's disease, Alzheimer's disease, endocrine disruption, and cancer of the organs. One recent study identified a role of drinking water and dietary nitrate in risks of thyroid cancer.[18] Generally, families drawing their water supply from farm areas experience the greatest exposure to elevated nitrate concentrations in drinking water.[19]

Nitrate as nitrogen concentrations of 4 mg/L or more in rural drinking-water supplies have been associated with increased risk of non-Hodgkin's lymphoma.[20] Additionally, researchers from the University of Iowa found that up to 20 percent of ingested nitrate is transformed in the body to nitrite, which can then undergo transformation in the stomach, colon, and bladder to form N-nitroso compounds.[21] These compounds are known to cause cancer in a variety of organs in more than 40 animal species, including higher primates.

In addition to nitrate, exposure to other agricultural chemicals is associated with public health risks. For example a recent study in the Salinas Valley identified effects on neurological development in children exposed to organophosphate pesticides.[22]

Staff has not measured the individual or cumulative costs of these public health consequences. The costs range from the direct costs incurred by individuals and their families in lost wages, medical expenses, and pain and suffering, to the collective costs to communities in declining productivity and wealth. Where public sector agencies expend resources to reduce or prevent these costs (e.g., well-head treatment for drinking water supply wells), the costs are alternately described as "Public Health" and "Environmental Health" expenditures. Environmental Health costs are discussed below.

5.2.2.2 Environmental Health

Environmental Health costs are defined here as costs incurred principally by public agencies and service providers for actions to address environmental quality problems. These costs may, but do not necessarily also benefit public health. For example the public health cost of contaminated water is borne by those individuals suffering from health effects and by the public at large. At the same time, the environmental health cost to clean up or prevent the pollution of a water supply falls largely on public

[18] Kilfoy BA, Zhang Y, Park Y, Holford TR, Schatzkin A, Hollenbeck A, Ward MH. 2010. ***Dietary nitrate and nitrite and the risk of thyroid cancer in the NIH-AARP diet and health study***. Sept. 7.

[19] R. B. Brinsfield and K. W. Staver, ***Addressing groundwater quality in the 1990 farm bill: Nitrate contamination in the Atlantic Coastal Plain***, Journal of Soil and Water Conservation, March 1990, vol 45., no. 2, 285-286.

[20] M.H. Ward, Mark S.D., Cantor K.P., et al., ***Drinking Water Nitrate and the Risk of Non-Hodgkin's Lymphoma***, Journal of Epidemiology and Community Health, 1996, Vol. 7, pgs 465-471.

[21] Peter Weyer, ***Nitrate in Drinking Water and Human Health***, 2001, http://www.agsafetyandhealthnet.org/Nitrate.PDF

[22] Marks AR, Harley K, Bradman A, Kogut K, Barr DB, Johnson C, et al. 2010. ***Organophosphate Pesticide Exposure and Attention in Young Mexican-American Children.*** Environmental Health Perspectives.

agencies and private water vendors who must spread these costs broadly among the populations they serve.

This discussion of environmental health costs is limited to those costs associated with addressing groundwater overdraft/seawater intrusion, and treating nitrate contaminated water supplies from groundwater.

The Draft Ag Order does not require any dischargers of irrigated agricultural runoff to implement treatment or to replace drinking water for public or domestic water supplies affected by agricultural pollutants, nor does it establish any conditions or criteria that would trigger these requirements. Therefore, the following costs are not costs to dischargers if the proposed order is adopted. Rather these costs provide examples and estimates of the current and potential future costs to restore groundwater to public health standards, if pollution continues unabated.

The Draft Ag Order does refer to the ***existing*** authority pursuant to Water Code §13304 for the Central Coast Water Board to require dischargers to provide alternative water supplies or replacement water service, including wellhead treatment, to affected public water suppliers or private domestic well owners. The Draft Ag Order does not add or invoke this authority, nor establish new requirements. Staff does not speculate here on if or how this authority might become a requirement for an individual agricultural discharger complying with the proposed order and therefore, cannot meaningful estimate cost to an individual discharger.

5.2.2.2.1 Cost of Treating Nitrate in Groundwater

Data from public supply wells in the Central Coast region suggest that the municipal beneficial use of groundwater is impaired or threatened by nitrates in several areas of the Central Coast region's groundwater basins. A Department of Water Resources survey of groundwater quality data collected between 1994 and 2000 from 711 public supply wells in the Central Coast found that 17 percent of the wells (121 municipal supply wells) detected a constituent exceeding one or more primary MCL.[23] Nitrate exceeded the MCL (45 mg/L nitrate as nitrate) the most, with approximately nine percent of the wells (64 wells) exceeding the MCL for nitrate. Research shows that nitrate concentrations found in groundwater above 14 mg/L (as nitrate) are likely from anthropogenic activity such as agriculture, so concentrations above 45 mg/L indicate a significant anthropogenic impact.[24] According to the State Water Board's GAMA Geotracker website, recent impacts to public supply wells are greatest in portions of the Salinas Valley (up to 20 percent of wells impacted) and the Santa Maria (approximately 17 percent) groundwater basins. In the Gilroy-Hollister groundwater basin, 11 percent are impacted but the California Department of Health identified more than half of the drinking water supply wells as vulnerable to agricultural related activities.

A study of sources of loading of nitrates and salts to the soil and potentially to groundwater in Santa Cruz and Monterey Counties indicated that irrigated agriculture

[23] Department of Water Resources, 2003. ***California's Groundwater Update, Central Coast Hydrologic Region.***
[24] W.M. Alley, 1993. Regional Ground-Water Quality. Van Nostrand Reinhold, New York NY

contributes approximately 78 percent of the loading.[25] Less than 50 percent of applied fertilizer-nitrogen is taken up by the crops and of the approximately 50 percent not taken up, approximately 25 percent is lost to the atmosphere due to ammonia volatilization.[26] Based on these proportions, approximately 38 percent or more of applied fertilizer-nitrogen is leached to groundwater.

Due to elevated concentrations of nitrate in groundwater, many public water supply systems have abandoned wells and established new wells or sources of drinking water, or are required to remove nitrate before delivery to the drinking water consumer, often, at significant cost.

Removing nitrates from groundwater is very expensive. There is significant variability in costs to remove nitrate from groundwater depending on whether the goal is to perform groundwater treatment at the wellhead or to achieve groundwater cleanup on a basin-wide scale. The cost estimates that follow were developed by cost modeling using data from existing pump-and-treat cleanup projects within the region, and present-day nitrate treatment and blending costs for groundwater projects throughout the State.

Current strategies for addressing nitrate in groundwater typically include avoidance (abandoning impacted wells or drilling adjacent deeper wells), groundwater treatment to remove nitrate (i.e., dilution using blending, ion exchange, reverse osmosis, biological de-nitrification, and distillation), or developing additional water supplies (i.e., percolation ponds, surface water pipelines, reservoirs) to dilute nitrate-impacted groundwater resources. The costs associated with these strategies vary depending on various factors including, but not limited to: affected population, area impacted by elevated nitrate concentrations, number of replacement wells needed, capacity and depth of replacement wells, concentration of nitrate to be treated, presence of other constituents in groundwater, distance to alternative low nitrate concentration water source, installation of new infrastructure (e.g., treatment system, conveyance pipeline, etc.), equipment costs, and long-term maintenance and operational expenses.

Private parties and municipalities with elevated nitrate concentrations in the wells they own and operate can incur significant costs to treat or lower nitrate concentrations.[27] Some options include:

- Rely on bottled water: Average costs to buy bottled water for a family of four: $190 per year[25]
- Remove nitrate at sink: Average cost to buy a nitrate removal system (under the sink-type reverse osmosis system): $800 plus $100 per year for maintenance[25]
- Wellhead treatment:

[25] Monterey County Flood Control and Water Conservation District, November 1990. "Report of the Ad Hoc Salinas Valley Nitrate Advisory Committee." Zidar, Snow, and Mills.
[26] Harter, Thomas, 2009. ***Agricultural Impacts on Groundwater Nitrate,*** in Southwest Hydrology, July/August.
[27] A.M. Lewandowski, B.R. Montgomery, C.J. Rosen, and J.F. Moncrief, ***Groundwater nitrate contamination costs: A survey of private well owners***, Journal of Soil and Water Conservation, May 2008, vol. 63, no. 3, 153-161.

  - Average cost to operate an ion exchange system for wellhead treatment on a private well (for a 15 gallons per minute well): $25,000 capital costs plus $37,000/year on operation and maintenance costs.[28]
  - Average cost to operate an ion exchange system for wellhead treatment on a municipal supply well (for a 1,000 gpm well): $200,000 plus operating and maintenance costs.
- Replace well:
  - Average cost to install a new replacement shallow private domestic supply well: $7,200.[25]
  - Average cost to install a municipal water supply well (see Table 20).

According to data prepared for the Central Valley Water Board, well replacement costs depend on the geology of the water supply area, well design and depth, well construction, pumping rate and wellhead protection. Table 20 presents a range of well replacement costs. Based on these costs the estimated total costs for well replacement and one year of operation and maintenance range from $76,500 to $1.085 million.[29]

Table 20: Well Replacement Costs

Well Size	**General Cost Assumptions**
10 to 30 gal/min (gpm)	$25,000 to $50,000 ($37,500 average)
30 to 100 gpm	$100,000
1,000 gpm to 2,000 gpm	Can he as high as $1 Million
Items	**Cost Ranges**
Labor per person	$30,000 to $60,000 per year
Power for <100 gpm size	$3,000 to $5,000 (average $4,000)
Administration/fees	$2,000 per year
Analytical Costs – Groundwater	$2,000 per year with no treatment or compliance issues
Maintenance – Groundwater	$1,000 per year if done by operator

Note: Actual costs should be verified by local drilling company
Source: CVRWQCB, 2010, p. 5-4, 5-5.

An example of well replacement costs in the Central Coast Region is provided by the Monterey County community of San Jerardo. At the October 23, 2009 Central Coast

[28] Stephany Burge and Rolf Halden, ***Nitrate and perchlorate Removal from Groundwater by Ion Exchange Pilot Testing and Cost Analysis***, Lawrence Livermore National Laboratory, University of California, Livermore, California, September 8, 1999.

[29] Central Valley Regional Water Quality Control Board (CVRWQCB). July 2010. ***Draft Technical Memorandum Concerning the Economic Analysis of the Irrigated Lands Regulatory Program.*** Prepared by: Megan Smith, ICF International; with assistance from: Mark Roberson, Ph.D., Stephen Hatchett, Ph.D., CH2MHill, and Thomas Wegge, TCW Economics.

Water Board hearing,[30] the Board approved a resolution requesting $543,826 of Cleanup and Abatement Account funding to assist San Jerardo in financing alternative water supply and interim nitrate treatment. This small rural community (approximately 60 households) located in an agricultural area southeast of Salinas has high levels of nitrate and 1,2,3-Trichloropropane (1,2,3-TCP) in groundwater. The community, whose water system has been under a bottled water order for drinking water since 2001, requested the funds in October 2009 to continue interim treatment of drinking water.[33] Up to that time, Monterey County incurred $615,582 in interim filtration system costs for the San Jerardo water supply, and anticipated an additional $232,400 in expenses through the expected completion date of an approximately $1 million project to permanently replace the water.[31]

When well replacement is not an option, either wellhead treatment (the interim strategy for San Jerardo) or basin wide cleanup (pump and treat) are the typical strategies for reducing nitrate in drinking water supplies. Cleanup strategies rely on source control/removal as the cornerstone component for nearly all groundwater cleanup sites in the Central Coast Region, and the cleanup strategy for nitrate is no different. So, these options are only reasonable if nitrate loading has been addressed through management practices, such as those required in the Draft Ag Order.

To understand the costs associated with nitrate cleanup, staff selected an example involving the cleanup of a perchlorate (a chemical similar to nitrate) plume within the Llagas Subbasin in Santa Clara County.[32] The extent of the perchlorate plume is approximately 10 miles in length and more than two miles in width. The plume also extends through three underlying aquifer zones, to depths greater than 500 feet. To clean up the perchlorate plume to background concentrations, consultants estimate that capital costs to install a hydraulic containment and treatment system (e.g., wells, piping, pumps, treatment system) with reinjection of treated water is approximately $32 million plus operation and maintenance costs estimated to be $11 million per year for at least 20 years. Over a 20-year timeframe, groundwater cleanup for the perchlorate plume described above will cost more than $250 million dollars.

A nitrate plume of similar magnitude would cost significantly more due to the increased cost of nitrate resin compared to perchlorate resin and due to waste disposal costs (nitrate ion exchange resin waste). The perchlorate plume described above is a small fraction of the size of the nitrate plumes found in most of the major groundwater basins throughout the region. Additionally, the nitrate plumes in the Llagas Subbasin and other basins are significantly more concentrated than the perchlorate plume described above. Increased concentration would significantly increase treatment cost regardless of treatment method. The Llagas Subbasin is one of many groundwater basins within the

[30] Central Coast Water Board October 23, 2009 Meeting Agenda: http://www.waterboards.ca.gov/centralcoast/board_info/agendas/2009/oct/item_12/index.shtml

[31] Monterey County Board of Supervisors October 27, 2009 Meeting Agenda http://publicagendas.co.monterey.ca.us/MG75707/AS75733/AS75740/AI84201/DO84202/1.DOC

[32] MACTEC Engineering and Consulting, Inc, ***Llagas Subbasin Cleanup Feasibility Study – Revised*** Olin/Standard Fusee Site, 425 Tennant Avenue, Morgan Hill, California, December 6, 2006

region that are severely impaired by discharges of nitrate associated with irrigated agriculture.

Given the extent of nitrate pollution in Central Coast groundwater basins, it would cost many times the costs identified for the Llagas perchlorate plume to cleanup nitrate pollution in the region's groundwater.

5.2.2.2.2 Cost of Groundwater Overdraft and Seawater Intrusion

Groundwater overdraft in a basin is a decrease in groundwater storage that results in a significant prolonged period of groundwater level declines. Along the Central Coast, prolonged periods of groundwater level decline are causing seawater intrusion into aquifers that are hydraulically connected to the Pacific Ocean. Overdraft can also cause upward or downward migration of poor-quality groundwater, loss of surface water flows, and land subsidence with corresponding permanent loss of aquifer storage capacity, as well as infrastructure and property damage (settlement damages sewers, other utilities, buildings, etc.).

Agriculture accounts for approximately 80 to 90 percent of groundwater pumping from the Salinas, Pajaro, and Santa Maria groundwater basins. The Gilroy-Hollister, Salinas, and Santa Maria groundwater basins are actively managed to enhance groundwater recharge from streams in order to meet pumping demand, but excessive pumping (primarily related to agriculture) continues to cause seawater intrusion into the Salinas and Pajaro groundwater basins, with increasing portions of the basins unusable for agriculture and municipal supply as a result.

The Salinas Valley Water Project illustrates the scale of costs associated with addressing seawater intrusion. The three major components of the project include, operation and maintenance of Nacimiento and San Antonio Reservoirs; construction of the modification to the spillway at Nacimiento Reservoir; and construction of the Salinas River Diversion Facility (Table 21). The project will reduce seawater intrusion from Monterey Bay into aquifers underlying the Salinas Valley agricultural region by providing a source of water to replace the use of groundwater. The project includes benefits beyond addressing seawater intrusion, groundwater quality and increased recharge, including: flood control, drought protection, and recreation.

The costs for the project are shared by all land owners with land under active use, including: residential, commercial, industrial, institutional, and irrigated agricultural uses. The project's annual assessment to landowners with land under these active uses is expected to range from \$3.99 to \$23.93 per acre. [33]

[33] Monterey County Water Resources Agency. ***Salinas Valley Water Project Cost Advisory Committee Draft Recommended Strategy***, November 2002, p. 9. http://www.mcwra.co.monterey.ca.us/SVWP/draft_final_CAC_summary.pdf

Table 21: Estimated Costs for Salinas Valley Water Project for Assessed Area[33]

Description	Capital Cost	Annual Cost
Operation and Maintenance of Nacimiento and San Antonio Reservoirs	-	$2,390,000
Construction of Modification to Nacimiento Spillway	$7,300,000	$470,000
Construction of Salinas River Diversion Facility	$11,500,000	$750,000
Maintaining Assessment Rolls		$273,000
TOTAL	**$18,800,000**	**$3,883,000**

In addition to the Salinas Valley Water Project, the Castroville Seawater Intrusion Project began construction in 1995 and started delivering recycled water to fields near Castroville in 1998, leading to reduced pumping of groundwater and slowing of the rate of seawater intrusion. More recently, the Watsonville Recycling Project came online. This project provides the Pajaro Valley Water Management (PVWMA) Agency with 4,000 acre-feet of water to distribute to farmers through the PVWMA's Coastal Distribution System. The combined cost of the Pajaro Water Recycling Project and the Coastal Distribution System is $65 million.[34] Grant funding from state and federal sources in the amount of $28 million[35] were requested to off-set the cost to affected landowners.

The PVWMA also constructed the Harkins Slough Project in 2001, to divert and filter wet-weather flows from Harkins Slough, to a recharge basin. The recharged groundwater is then extracted and delivered during the irrigation season for growers through the Coastal Distribution System. Operation of the Harkins Slough project with other supplemental water projects in the basin, help reduce overdraft and slow the rate of seawater intrusion. [36] The project also offers flood control benefits to Watsonville. Excessive sedimentation now prevents the project from functioning as designed and additional public funds are being requested to improve the project's function and improve management of the Watsonville Sloughs wetlands ecosystem.[37]

While these are only examples of projects whose principal purpose is to address the problems caused by groundwater overdraft, they clearly illustrate that overdraft and associated seawater intrusion are significant problems that require expensive public works and capital projects to address. These examples further illustrate that the costs of these large-scale projects are borne not exclusively by the agricultural industry, which has the primary role in causing overdraft in most of our over drafted basins, but also by the public in the form of individual assessments on property, higher prices for delivered water, and state and federal subsidies.

[34] Eric Anderson, "Water Recycling Project about 95 Percent Complete," Register Pajaronian, October 9, 2008.

[35] Pajaro Valley Water Management Agency, 2010. Web page on Watsonville Area Water Recycling Project: http://www.pvwma.dst.ca.us/project_planning/projects_recycling.shtml

[36] Pajaro Valley Water Management Agency, 2010. Proposition 218 Service Charge Report. March. p. 8.

[37] Regional Water Management Foundation, 2010. ***Santa Cruz IRWM Prop 84 Planning Grant Application***, Attachment 3, p. 23.

5.2.2.2.3 Municipal Stormwater Agency Costs

Throughout the Central Coast region, cities and towns have grown alongside a growing agricultural industry resulting in stormwater conveyances that drain both municipal and agricultural lands. Both wet and dry season flows from urban and farm lands commingle in many of these conveyances before discharging to receiving waters. Municipal stormwater discharges are subject to NPDES permits, which require municipalities to address the quality of the discharges from their stormwater drainage facilities to the maximum extent practicable. Where municipal stormwater facilities include non-stormwater tailwater and/or farm stormwater runoff in their discharges, the municipalities are currently under regulatory requirements to implement best management practices to reduce pollutants to the technology-based standard of maximum extent practicable.

Municipal stormwater permits in the Central Coast Region require municipalities to address commingled urban-farm runoff during the current five-year permit cycle. Staff anticipates municipalities will incur costs associated with coordination with growers in and outside of incorporated communities, targeted assessment and monitoring, and capital projects to treat, separate and/or divert flows.

The City of Watsonville incurred such costs when the City constructed a detention system and large trash rack alongside a residential subdivision. The City estimates that approximately 80 percent ($2 million) of the project costs were expended because of agricultural drainage related sedimentation problems caused by a conversion from orchard to strawberry cultivation, upstream, in erosive soils. [38] The City also reports expenditures of approximately $1.4 million to construct cast-in-place culverts and a new pump station at Corralitos Creek to handle additional flow volumes from agricultural areas upstream. [38]

5.2.2.3 Environmental Justice

California statute defines Environmental Justice as "the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of all environmental laws, regulations, and policies" (Government Code Section 65040.12).[39] Across the nation, poor and minority communities more often suffer from the impacts of exposure to pollution, poor air and water quality and associated health hazards. The impacts of nitrate contamination on disadvantaged communities may in some communities be considered Environmental Justice impacts.

The costs of drilling a new well or paying for water treatment can be infeasible for small, disadvantaged communities, such as San Jerardo, discussed above, and Chualar, a 900-resident economically disadvantaged community just south of Salinas where nitrate

[38] City of Watsonville Public Works, Robert Ketley.

[39] Consistent with legislative mandates, the State Water Resources Control Boards' Environmental Justice Program includes the goal of integrating Environmental Justice considerations into the development, adoption, implementation and enforcement of Board decisions, regulations and policies.

contamination of the water supply was identified in 1996.[40] The impact is also felt among poor and minority communities in cities such as Salinas, Watsonville, King City and Soledad, where ratepayers pay higher prices for water treatment compared to communities relying on uncontaminated groundwater.

Impacts on Environmental Justice are a social cost of irrigated agriculture as it is practiced under current water quality regulations in the Central Coast Region. While the monetary costs of addressing contaminated drinking water are quantifiable, as described in the Environmental Health examples above, Environmental Justice represents a social value whose loss comes at incalculable costs. Should implementation of the Draft Ag Order result in reduced incidence of drinking water contamination in disadvantaged and minority communities, these social costs would be reduced.

5.2.3 Environmental Cost of Current Conditions

5.2.3.1 Watershed Health

The Draft Ag Order addresses the effects of irrigated agriculture on water quality. Irrigated agriculture has the potential to alter the various processes governing surface water, groundwater, sediment, and aquatic habitat, which play out at the watershed scale. The Draft Ag Order is intended to ensure protection of water quality, beneficial uses, and the biological and physical integrity of watersheds and aquatic habitat.

The costs of failing to provide this protection are manifest in many ways that have been described in detail elsewhere. Where these costs are translated into monetary quantities, such as when dollars are expended to address seawater intrusion caused by over-pumping, or, to reduce flooding impacts exacerbated by loss of flood storage, they can be construed as costs to the public. Where the dollar value of these costs is not known or has not been estimated, they represent agriculture's unquantified cost to watershed health.

5.2.3.1.1 Land Productivity

The effect of irrigated agriculture on land productivity is difficult to quantify, but information is provided in this Technical Memorandum to be considered when reviewing costs potentially affected by the Draft Ag Order. Declining productivity of agricultural land can eventually lead to an exhausted resource. The long-term productivity and profitability of irrigated agriculture is determined largely by factors such as prices for crops, labor supply, markets, accessibility, and land tenure. But it also depends on practices that maintain and conserve the native land's characteristics contributing to long-term productivity.

Soil loss, soil salinization, seawater intrusion, land subsidence, and contamination by agricultural chemicals are examples of consequences of unsustainable agricultural practices that can result in potentially lasting negative effects on land productivity.

[40] Monterey County Water Resources Agency, May 2006. ***Salinas Valley Integrated Regional Water Management Functionally Equivalent Plan Summary Document Update***. P. 14-3.

Central Coast irrigated agriculture has witnessed some of these effects, most notably seawater intrusion, and the prospect of further declines in productivity exists. Critically, declining productivity from greater intensity of cultivation can result in increased dependence on synthetic nutrients, increasing the risk that applied chemicals will reach surface waters and groundwater in concentrations above protective levels.

5.3 The Triple Bottom Line

The above discussion of financial, social, and environmental costs associated with irrigated agriculture addresses the broad spectrum of effects that could potentially result from implementation of the Draft Ag Order. This framing of the consideration of costs is consistent with what has been termed the “triple bottom line,” which attempts to describe the social and environmental impact of an organization’s actions to provide a more in-depth evaluation to its economic effects (Presidio Graduate School, 2010).

In considering the costs for the agricultural industry to comply with water quality regulations, the triple bottom line is a useful concept, since these costs are not accurately viewed in isolation from the other social and environmental costs such as those discussed here. The industry’s characteristic externalities, which transfer costs to the public-at-large (e.g., groundwater cleanup costs), and the public’s share of the cost of production in the form of public subsidies (e.g., federal funding from Environmental Quality Incentives Program) are examples of what is revealed by a more comprehensive analysis of cost.

ATTACHMENT 1:

TABLES SUPPORTING MONITORING COST DISCUSSION

TABLE: RECEIVING WATER MONITORING COST BASIS															
	Laboratory Costs ($)								Receiving Water Monitoring						
	Lab 1	Lab 2	Lab 3	Lab 4	Lab 5	Lab 6	Routine site visit	Test Avg.	No. of Trend	No. of Storm water	No. of Dry Season	QA Sites	No. of Sites	Annual ($)	5-Year Cost ($)
Field Visit (including flow and field measures)							400		12	2			45	252,000	1,260,000
Total Nitrogen		60	60	20				47							
Nitrate+Nitrite		25	30	20				25	12	2		2	45	16,538	82,688
Total Ammonia	35	35	30	20				30	12	2		2	45	19,845	99,225
Orthophos	see NO	25	60	20				35	12	2		2	45	23,153	115,763
Kjehldahl Nitrogen		26	30	30				29	12	2		2	45	18,963	94,815
Total Phosphorus		16	18	20				18	12	2		2	45	11,907	59,535
Total Organic Carbon		12	30	40				27	12	2		2	45	18,081	90,405
Hardness		13	10	20				14	12	2		2	45	9,482	47,408
TDS	35	15	25	12				17	12	2		2	45	11,466	57,330
Color		15	10	15				13							
Chlor a	71	60	75	50				64	12	2		2	45	42,336	211,680
pH		5	5	10				7	12	2		2	45	4,410	22,050
Conductivity		5	5	10				7	12	2		2	45	4,410	22,050
Turbidity		8	5	12				8	12	2		0	45	5,250	26,250
Total and fecal		30	10	30				23	4	2		0	45	6,300	31,500
E. coli		25	10	30				22	4	2		0	45	5,850	29,250
Toxicity															
Ceriodaphnia	750	733	650	375	735			649		2	2	0	45	116,760	583,800
Selenastrum	750	733	650	650	735			704		2	2	0	45	126,660	633,300
Pimephales	775	733	250	375	735			574		2	2	0	45	103,260	516,300
Hyallela in sed		1000			1040			1020			1	0	45	45,900	229,500
Pyrethroid suite		350				395		373			1	0	45		16,763
Organochlorine in sed		130	225	125				160			1	0	45		7,200
Particle size		15	50	75				47			1	0	45		2,100
OP suite	561	175	225	100		190		250		2	2	0	45		45,036
Nitrogen Pesticides (includes atrazine, cyanazine, simazine)		210		190				200		2	2	0	45		36,000
Carbamates (includes diuron, glyphosate, linuron)		160		265				213		2	2	0	45		38,250
Metals															
Boron		5	7	10				7		2	2	0	45		1,320
Cadmium		6	10	30				15		2	2	0	45		2,760
Copper		6	10	30				15		2	2	0	45		2,760
Lead		6	10	30				15		2	2	0	45		2,760
Nickel		6	10	30				15		2	2	0	45		2,760
Molybdenum		6	10	10				9		2	2	0	45		1,560
Selenium		6	10	30				15		2	2	0	45		2,760
Zinc		6	10	30				15		2	2	0	45		2,760
Phenol		40						40		2	2	0	45		7,200
Paraquat dichloride				75				75		2	2	0	45		13,500
Bioassessment	750							750			1		45	33,750	33,750
TIE Water	4250				6000			5125			5			25,625	128,125
TIE Sediment	4250				6000			5125			5			25,625	128,125
Subtotals														**927,570**	**4,688,336**
5-Year Cost															**4,688,336**
Average Annual Cost															**937,667**

TABLE: GROUNDWATER MONITORING COST ESTIMATE										
				Tier 1 and 2			Tier 3			
	Cost/visit ($)	Add l Well Cost ($)	Analysis Cost ($)	No. of wells	No. of Samples	5- yr cost ($)	No. of wells	Frequency First Year	Frequency other 4 years	5-year cost ($)
Field Visit (including depth and field measures)	300	150		1	2	$600	2	4	1	$3,600
Mineral Suite (GAMA)			**95**	1	2	$190	2	4	1	$760
Cost/grower/5 Yr						$790				$4,360
No.of Growers						1,600				100
						$1,264,000				$436,000
TOTAL 5-YR PROGRAM COST ALL TIERS										**$1,700,000**

Exhibit 10

STATE OF CALIFORNIA
REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION

STAFF REPORT FOR REGULAR MEETING OF FEBRUARY 3, 2011
Prepared on January 10, 2011

ITEM NUMBER: **18**

SUBJECT: **Summary of Water Board Grant Funding for Agriculture**

DISCUSSION

Water Board Statewide Funding for Agriculture Related Projects: Over $600 Million Since 2000

Since the year 2000, the State and Regional Water Boards have made available over $608 million of public grant funds to address agricultural issues (Table 1, below). These funds came from Propositions 13, 40, 84, and 50, and addressed a myriad of water quality projects, watershed protection, and nonpoint source pollution control throughout the State. In addition, the State Water Board also allocates approximately $4.5 million per year in 319h program funding to address non point source pollution.

TABLE 1: Statewide Grant Funding for Agriculture Related Projects
State Water Resources Control Board
Propositions 13, 40, 84, and 50 Funding Programs

Prop	Grant Program	Local Assistance Available ($)
50	Agricultural Water Quality through FY05	20,215,736
40	Agricultural Water Quality through FY05	2,500,000
50	Agricultural Water Quality	9,284,264
40	Agricultural Water Quality	8,900,000
50	Coastal Non Point Source	33,200,000
40	Non point Source	19,000,000
40	Integrated Watershed Management	47,500,000
50	CALFED Drinking Water	20,500,000
50	Dairies	5,000,000
50	CalFED Watershed	20,000,000
50	Integrated Regional Water Management	183,000,000
13	Watershed Protection	82,800,000
13	Nonpoint Source Pollution Control	92,000,000
13	Coastal Nonpoint Source Pollution Control	50,502,000
84	Agricultural Water Quality	13,725,000
	TOTAL	**$608,127,000**

The $608 million in Table 1 does not include other agriculture related funding provided by many other state and federal agencies.

Recent Central Coast Grant Funding Related to Agriculture: Over $55 million

The amount of public Water Board grant funds recently awarded on the Central Coast for agriculture related projects is over $55 million. Most of these funds were awarded in the last ten years.

There are several grant programs that have provided (or are providing) funding for agriculture related projects on the Central Coast. The Integrated Watershed Regional Management (IWRM) grant funds are providing over $14 million for agriculture related projects, summarized below in Table 2. These projects are managed by the State Board or the Department of Water Resources.

TABLE 2: Central Coast Integrated Watershed Regional Management Grants Related to Agriculture

Funding Area	Grantee	Amount	Notes	Grant #
Santa Cruz	Santa Cruz County Resource Conservation District	$690,000	Watsonville Sloughs Integrated Watershed Restoration	07-507-550-0 Component 12
Santa Cruz	Santa Cruz County Environmental Health	$350,000	Coordinated Monitoring Program – Implementation Monitoring of Watershed Restoration	07-507-550-0 Component 15
Greater Monterey	Monterey County Water Resources Agency	$997,000	The Salinas Valley Fish Habitat and Monitoring Program	Prop 50 Supplemental (see below)
Pajaro	Pajaro Valley Water Management Agency	$4,664,640	Coastal Distribution System (Subset of larger project)	4600007652
Pajaro	City of Watsonville	$6,825,300	Recycled Water Treatment Facility (Subset of project below)	4600007652
Pajaro	Resource Conservation District of Santa Cruz County	$503,656	Erosion Control, Vegetative Treatment and Riparian Restoration (subset of larger project)	4600007652

TOTAL: $14,030,596

In addition, Table 3 lists Central Coast specific projects related to agriculture funded by the Proposition Bonds and Central Coast Water Board settlement funds. These agriculture related projects include research, BMP implementation and demonstration, treatment systems, monitoring, and habitat conservation and restoration. Table 3 is a PARTIAL list. The Water Board funded MANY more agriculture related projects in the 1980s, and 90s. The total from Table 2 and Table 3 is over $48 million.

TABLE 3: Summary of Central Coast Water Board Grants Related to Agriculture

Grant No.	Program	Project Name	Grant Amount	Grantee/ Project Director	Final Invoice
05-102-553-0 05-102-553-1 05-102-553-2	Prop 40 AWQGP	Long term, high res nutrient/sediment monitoring and characterizing	$499,999	UC Santa Cruz Marc Los Huertos	11/1/2008 11/1/2008 12/1/2008
06-128-553-0	319(h)	Morro Bay On-Farm Coastal Water Quality Implementation Project	$500,000	Coastal San Luis RCD Deborah Barker	2/1/2008
06-161-553-0 06-161-553-1	Prop 40 IWM	Integrated Watershed Restoration Program Ph II	$4,048,135	Santa Cruz Co. RCD Karen Christensen	2/1/2010
06-273-553-0 06-273-553-1	Prop 40 Prop 50 AWQGP	Research Implement. BMP's Protect Water Qual, Cent. Coast Vineyard	$499,830 $499,830	Santa Cruz Co. RCD Karen Christensen	5/1/2009
06-274-553-0	Prop 40 Prop 50 AWQGP	Demonstrate Capability Water Quality/Food Safety through Research Implementation	$600,000 $400,000	Central Coast Ag. Quality Coalition Dawn Mathes	4/1/2009
06-275-553-0	Prop 40 Prop 50 AWQGP	Research/Implement BMP's/ Protect Water Quality Cent. Coast Vineyard	$340,000 $340,000	Central Coast Vineyard Team Kris O'Connor	4/1/2009
7-090-253-0	319h NPS	San Lorenzo River Watershed Mgmt	$120,700	Coastal San Luis RCD	Closed
7-104-253-0		NPS Pollution in Salinas Valley-Carr Lake	$191,970	CA State University Monterey Bay	Closed

7-116-253-0	319h NPS	Nitrate Management	$80,000	Monterey County Water Resources Agency	Closed
8-065-253-0	319h NPS	Volunteer Monitoring Marine Sanctuary	$75,000	Center for Marine Conservation	Closed
8-115-253-0	319h NPS	Salinas Valley Eastside Watershed Project -Farm/Ranch Outreach	$102,000	Monterey County RCD	Closed
8-117-253-0	319h NPS	Reduce NPS Pollution in the lower Salinas River-Implementing regulatory coordination for ag management practices.	$60,000	Monterey Bay National Marine Foundation	Closed
8-257-130-0		Elkhorn Slough Watershed Ag Outreach Project	$327,647	Monterey County RCD	Closed
9-078-253-0	319h NPS	Monterey Bay Regional Marketing Initiative-Collaborate with ag community to develop programs to encourage BMPs.	$145,820	Community Alliance with Family Farmers (CAFF)	Closed
9-193-130-0	319h NPS	Citizens Monitoring Group	$49,998	Monterey Bay Sanctuary Found.	closed
00-097-253-0	319h NPS	Demonstration Farm & Outreach Program	$345,600	Ag Land Based Training Assoc, Inc (ALBA)	Closed
00-147-253-0	319h NPS	Erosion and Nutrient Mgmt I Salinas and Pajaro Valleys	$310,800	Monterey County RCD	Closed
00-148-253-0	319h	Outreach and Education Elements of the Salinas Valley Nitrate Mgmt Plan	$288,000	Monterey County Water Resources Agency	Closed
00-152-253-0		Morro Cojo Slough-Remediate NPS Pollution	$340,000	San Jose State University Found.	Closed
00-202-130-0	Cost Savings	Oso Flaco Creek Watershed Run-off Assessment and Outreach Plan	$200,000	Cachuma RCD	Closed

00-239-130-0	TMDL NPS	Pajaro River Watershed Enhancement Planning	$179,544	Monterey Bay Sanctuary Found.	Closed
01-066-253-0	Prop 13	Central Coast Vineyards-reduce off-site movement of silt and water	$256,680	Central Coast Vineyard Team	Closed
01-113-130-1	TMDL	Volunteer Monitoring Program	$34,999	Monterey Bay Sanctuary	Closed
01-134-253-0	Prop 13	San Antonio Coordinated Resource Mgmt Plan	$20,000	Cachuma RCD	Closed
01-142-253-0		Outreach and Education of BMPs	$130,000	Upper Salinas Las Tablas RCD	closed
01-204-130-0	TMDL	Watsonville Slough-Develop and implement specs for pathogens and sediment	$166,437	University of CA Foundation	Closed
01-244-130-0	TMDL	Santa Margarita Ranch Ag Run-off Monitoring	$28,930	Regents of University of CA	Closed
02-071-253-0	Prop 13	Vegetative Conservation Practices-Pajaro Valley	$331,298	CAFF	Closed
02-056-130-1	TMDL	Pajaro River Watershed Nutrient Loading Assessment	$149,853	Regents of University of CA	Closed
01-051-253-0		Farm WQ Planning	$345,004	Regents of University of CA; Ag and Natural Resources	Closed
03-069-553-0	319h	Central Coast Farmland Demonstrating WQ Improvements	$347,346	Cachuma RCD	Closed
03-174-253-0	TMDL	Regional Mapping and Pesticide Data Replication	$19,900	CSUMB	Closed
03-184-553-0	Prop 13	Soquel Creek Lagoon	$344,900	City of Capitola	Closed
03-187-553-0	Prop 13	Pajaro River Watershed WQ Protection & Wetland Restoration	$2,271,877	Santa Cruz Co. RCD	Closed

03-193-553-0	Prop 13	Gabilan Watershed-address pollutants, restore natural function of watershed, reduce erosion and sedimentation,	$1,400,184	San Jose State University Found - Moss Landing Marine Lab.	closed
04-133-553-0	319h	Arroyo Grande Creek On-farm Coast WQ Implementation Projects	$277,645	Coastal San Luis RCD	Closed
04-138-553-0	Prop 13	Biologically Integrated Farming Systems	$680,500	Central Coast Vineyard Team	Closed
04-143-553-0	Prop 13	Irrigation & Fertilization Mgmt Assistance	$899,995	Santa Clara Valley Water District	Closed
04-145-553-0	Prop 13	Gabilan Watershed Identification of Toxic Pesticides - determine effectiveness of Ag conservation practices & stream restoration	$190,000	Monterey County RCD	Closed
04-320-553-0	Prop 50 AWQGP	Vineyard Ag Waiver	$242,762	Central Coast Vineyard Team	Closed
04-326-553-0	Prop 50 AWQGP	WQ Practice Implementation on Irrigated Ag Lands	$1,000,000	Monterey County RCD	Closed
04-400-553-0	Prop 50 AWQGP	Mgmt Practices to Improve WQ San Luis Obispo and Santa Barbara Counties	$999,133	Central Coast WQ Preservation Inc	Closed
05-103-553-0	Prop 40 AWQGP	Determine Ag Sources of Persistent Impairment to WQ Reg 3	$499,900	Central Coast WQ Preservation Inc	Closed
05-105-553-0	Prop 50 AWQGP	Mgmt Practices to Improve WQ Pajaro, Salinas, Elkhorn Watersheds	$999,133	Central Coast WQ Preservation Inc	Closed
05-122-553-0	319h	Reduction Nutr. Pesticide Loads, Wetlands Treatment	$500,000	Monterey County RCD	Closed

05-176-553-0	Prop 50 AWQGP	Ag NPS Reduction Demonstration and Outreach	$206,463	Ag Land Based Training Assoc, Inc	Closed
05-185-553-0	Prop 50 AWQGP	Irrigated Ag BMP Implementation	$770,104	Cachuma RCD	Closed
06-045-553-0	319h	Vegetative Treatment Systems and Far WQ Plans (FWQP) Implementation	$999,397	Santa Cruz Co. RCD	closed
06-353-553-0	Prop 50 CNPS	Assessment of State-Funded Wetland Restoration Projects Region 3	$400,000	San Jose State University Found. - Moss Landing Marine Labs	Active
09-348-553-0	Prop 50 AWQGP	Nutrient, Pathogen & Sediment Pollution Reduction from Livestock Facilities	$999,689	Ecology Action of Santa Cruz	Active
09-350-553	Prop 50 AWQGP	Pajaro Watershed Ag Irrigation and Nutrient Mgmt Project	$750,000	Santa Cruz Co. RCD	Pending
10-415-553-0	Prop 84 AWQGP	Implementation of Irrigation and Nutrient Mgmt Projects in the Lower Pajaro Watershed	$500,000	Santa Cruz Co. RCD	Pending
10-423-553-0	Prop 84 AWQGP	Central Coast Irrigation and Nutrient Mgmt Program, Santa Maria Watershed	$1,250,000	Cachuma RCD	Pending
10-424-553-0	Prop 84 AWQGP	Salinas Valley Watershed Irrigation and Nutrient Mgmt Program	$1,250,000	Monterey Bay Sanctuary Foundation	Pending
10-440-553-0	319h NPS	Morro Bay Ag WQ Enhancement Program	$465,500	Coastal San Luis RCD	Pending
Following Projects Awarded by Regional Board from Settlement Funds					
01-RB-06	Unocal, Avila Settlement	South SLO Creek-restore functional wetland, improving WQ, reduce NPS pollution discharges	$50,000	SLO County Land Conservancy	Closed
98-289-8	Unocal, Guadalupe Settlement	Santa Maria Estuary Plan	$440,000	CA Coastal Conservancy	Closed

98-289-12	Unocal, Guadalupe Settlement	Central Coast Watershed Coordinator	$658,103	Central Coast Wine Growers Assoc.	Closed
98-289-15	Unocal, Guadalupe Settlement	Central Coast Farm WQ Courses	$49,924	UC Cooperative Extension SLO County	Closed
98-289-16	Unocal, Guadalupe Settlement	Central Coast Cooperative Monitoring	$622,321	Central Coast WQ Preservation Inc	Closed
2004-0579	PGE Monitoring Funds	Monitoring of long-term large scale watershed level	$250,000	Central Coast Ag WQ Coalition	Active
2004-0582	PGE Monitoring Funds	Watershed scale WQ trend monitoring for Carneros and Corn Cob Canyon Creek	$49,999	CSUMB	Active
2006-0387	PGE Monitoring Funds	Ambient Monitoring in Elkhorn Slough	$49,680	Elkhorn Slough Foundation	Active
2004-0575	PGE Project Funds	Design and Implement conservation practices to improve WQ in Moss Landing Harbor and tributaries	$282,290	Monterey County RCD	Active
2004-0576	PGE Project Funds	Plan, design supervise construction of conservation practices to arrest erosion at three gully sites on two properties	$49,925	Monterey County RCD	Active
2005-0438	PGE Project Funds	Irrigation and Nutrient Mgmt-Implement enhanced irrigation and nutrient mgmt practices in North Monterey County	$49,843	Monterey County RCD	Active
2004-0680	PGE Project Funds	Elkhorn Slough Watershed-underground pipe installation and sediment basin construction	$49,893	Monterey County RCD	Active

2004-0681	PGE Project Funds	Moro Cojo/Santa Rita Creek-underground pipe installation and sediment basin retrofits	$49,883	Monterey County RCD	Active
2004-0682	PGE Project Funds	Carneros Creek-underground pipe installation and sediment basin construction	$49,870	Monterey County RCD	Active
2005-0734	PGE Project Funds	1) Convert existing on-farm drainage canals and ditches into vegetated treatment systems/monitoring. 2) Stabilize 1000-foot section of Santa Rita Creek & and parcel immediately upstream.	$500,000	Monterey County RCD	Active
2005-0735	PGE Project Funds	Vegetative Treatment Systems-modeling calculations	$49,999	CSUMB	Active
2005-0437	PGE Project Funds	Wetland Restoration-Plans	$179,543	Ag Land Based Training Assoc, Inc	Active
2006-0384	PGE Project Funds	Wetland Restoration-Implementation	$190,000	Ag Land Based Training Assoc, Inc	Active
2006-0385	PGE Project Funds	Vegetative Waterways	$200,000	Central Coast Ag WQ Coalition - CAFF	Active
2008-0481	PGE Project Funds	Irrigation & Nutrient Mgmt	$49,980	UC Davis	Active
2009-0179	PGE Project Funds	Demonstrating Best Mgmt Practices for Coastal Vegetable Production	$47,897	UC Davis	Active
		TOTAL	**$34,191,652**		

AWQGP – Agricultural Water Quality Grant Program
CAFF – California Alliance with Family Farmers

In addition to the $48 million in grants listed above in Tables 2 and 3, the Central Coast Water Board also allocated $7 million to the Elkhorn Slough Foundation to mitigate impacts caused by the Moss Landing Power Plant. The Elkhorn Slough Foundation has successfully leveraged these funds into tens of millions of dollars in on-the-ground projects. These projects include funding for BMP research and demonstration, sustainable farming demonstration, and extraordinary habitat conservation and restoration. When this $7 million in funding, and leveraging, is included, the total amount of recent agriculture related grants on the Central Coast is well over $55 million. This does not include funding from many other state and federal agencies.

CONCLUSION

The amount of funding for agricultural related projects on the Central Coast in the past 10 to 15 years is over $55 million. With all this funding, the water quality problems, including pollution of drinking water wells, continue to get worse and the threat to public health is increasing dramatically. For water quality and public health problems of this severity and magnitude, our primary responsibility must be to establish meaningful and comprehensive requirements to reduce pollutant loading, establish meaningful time schedules to achieve compliance, have transparent on-site compliance monitoring, and initiate enforcement for non compliance. Future funding for agriculture related projects should only be done in concert with comprehensive requirements and large-scale treatment solutions. Grant funding in lieu of comprehensive requirements will only make the problems worse.

In reviewing these grants, there is a definitive lack of funding toward the Water Board's highest priority—protecting people from drinking water pollution. In preparing for the new Irrigated Agriculture Order, the Water Board and staff have learned much more about the severe impacts caused by nitrate pollution in groundwater, and that thousands of residential domestic wells may be polluted or threatened. This issue is staff's highest priority, and we are working to direct grant funds and other resources toward this priority (in addition to renewing the Irrigated Agriculture Order to address this critical issue).

RECOMMENDATION

This session is for discussion only.

STATE OF CALIFORNIA
REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION

STAFF REPORT FOR REGULAR MEETING OF FEBRUARY 3, 2011
Prepared on January 10, 2011

ITEM NUMBER: **19**

SUBJECT: **Discussion Regarding Technical Services Available to the Agriculture Industry and Potential Solutions to Water Quality Problems**

DISCUSSION

This item is a placeholder for a discussion regarding technical services available to the agriculture industry and potential solutions to water quality and habitat issues associated with irrigated agriculture.

There are many consulting companies and hundreds of individual experts who work in the field of environmental sciences, investigations, corrective actions, treatment system design, sampling, and reporting on the Central Coast. These companies and individuals provide technical services for thousands of cases regulated by the Water Board and other agencies, and are available to assist the agriculture industry in complying with Water Board requirements. Water Board staff will be compiling a list of such companies over the next several months (not as an endorsement, but as information).

In addition, the Natural Resource Conservation District (NRDC), County Resource Conservation Districts (RCDs), and UC Extension offices provide technical services to help the agriculture industry change its farming practices and achieve compliance.

There are also many non-profit agriculture organizations and initiatives that promote and demonstrate sustainable agriculture, and provide education and support.

Also, as reported in item No. 18, the Water Boards have provided hundreds of millions of dollars in public funds to assist the agriculture industry statewide, with tens of millions provided on the Central Coast.

Solving the severe groundwater and surface water pollution problems on the Central Coast is our top priority, and will require a comprehensive regulatory program designed to require significant reductions in pollution discharges on a defined schedule, compliance monitoring, and enforcement for non-compliance. As with all other Water Board programs, this approach will provide incentive to change, innovate, and implement treatment systems on individual, group, and regional scales.

RECOMMENDATION

This session is for discussion only.

PUBLICATION 8097 FWQP FACT SHEET 3.4

Management Goals and Management Practices:

Nutrient Management Goals and Management Practices for Cool-Season Vegetables

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NRCS
Natural Resources Conservation Service

http://www.nrcs.usda.gov

Farm Water Quality Planning

A Water Quality and Technical Assistance Program for California Agriculture

http://waterquality.ucanr.org

This FACT SHEET is part of the **Farm Water Quality Planning (FWQP)** series, developed for a short course that provides training for growers of irrigated crops who are interested in implementing water quality protection practices. The short course teaches the basic concepts of watersheds, nonpoint source pollution (NPS), self-assessment techniques, and evaluation techniques. Management goals and practices are presented for a variety of cropping systems.

UC PEER REVIEWED

This Fact Sheet includes Management Goals and Management Practices for reduction of nutrient pollution in cool-season vegetables. For our purposes, we are defining a *Management Goal* (MG) as the best economically achievable technology or process for limiting the movement of nutrients, particularly nitrogen (N) and phosphorus (P), into ground or surface waters. Management Goals are general (for example, "Base the amount and timing of N fertilizer applied on crop needs").

As used here, a *Management Practice* (MP) is a specific practice to be used in accomplishing a Management Goal (for example, "Use plant tissue analysis to aid in fertilization decisions"). Growers and crop advisors have found these practices suitable for vegetable production in California's coastal region. Management Practices are not requirements and will not necessarily be feasible or necessary for pollution control in every situation. Rather, they are options for managing N and P fertilizers and water efficiently.

The development of a comprehensive farm plan for nutrient management on cool-season vegetable crops involves a series of ten Management Goals:

- MG 1. Evaluate current irrigation and fertilization practices and plan improvements in management.
- MG 2. Avoid fertilizer material spills during all phases of transport, storage, and application.
- MG 3. Base the amount and timing of N fertilizer applications on crop needs and production goals.
- MG 4. Place N fertilizer materials where maximum plant uptake will occur.
- MG 5. Minimize leaching losses of nitrate during non-crop periods.
- MG 6. Operate irrigation systems to minimize deep percolation and N losses.
- MG 7. Improve the uniformity of existing furrow irrigation.
- MG 8. Improve the uniformity of existing sprinkler irrigation.
- MG 9. Improve the uniformity of existing drip irrigation.
- MG 10. Evaluate and maintain nutrient management goals and recommended practices.

To implement the Management Practices, you may require specific technical information. Consult your local UCCE Farm Advisor or visit the UC Davis Vegetable Research and Information Center Web site for help with developing these practices.

MG 1. Evaluate current irrigation and fertilization practices and plan improvements in management

MP 1.1. Determine nitrate and salt contamination of ground water in existing wells; and assess the potential for transport of soluble contaminants such as nitrates and salts downward to the ground water and laterally to surface

MP 1.2. Develop and implement a system for keeping long-term records on each field for water and nutrient/soil amendment inputs, cultural operations, pest problems, land leveling or other improvements, and crop yield and quality. The Farm Water Quality Plan (ANR Pub 9002) gives one method for developing a long-term system.

MP 1.3. Review current cultural practices to develop improved nutrient and water management plans.

MG 2. Avoid fertilizer material spills during all phases of transport, storage, and application

MP 2.1. Have organized training sessions for field personnel.

MP 2.2. When transporting fertilizer, do not overfill trailers or tanks. Cover or cap loads properly and display appropriate placards on vehicles.

MP 2.3. When transferring fertilizer into on-farm storage or into a fertilizer applicator, take care not to allow materials to accumulate on the soil.

MP 2.4. Maintain all fertilizer storage facilities to meet government and industry standards and protect them from the weather.

MP 2.5. Clean up fertilizer spills promptly.

MP 2.6. Shut off fertilizer applicators during turns and use check valves on application equipment.

MP 2.7. Maintain proper calibration of fertilizer application equipment.

MP 2.8. Whenever injecting fertilizer into irrigation water, ensure that there is no backflow into wells or other water sources.

MP 2.9. Distribute rinse water from fertilizer application equipment evenly throughout the field.

MG 3. Base the amount and timing of N and P fertilizer applications on crop needs

MP. 3.1. Determine crop nutrient requirements and establish a crop nutrient budget.

MP 3.2. Measure nitrate levels in the irrigation water and adjust N fertilizer rate accordingly.

MP 3.3. Before applying N and P early in the growth cycle, assess the amount of nitrate and phosphorous already present through the use of soil sampling and analysis. For soils with pH > 6.2, the most appropriate soil test is the Olsen (or *bicarbonate*) procedure. The Olsen procedure is acceptable for soils with a lower pH, but some laboratories may recommend a different method.

MP 3.4. Use soil nitrate quick tests or plant tissue sampling to guide your decisions on N fertilization in the middle and late periods of the crop growth cycle.

MP 3.5. Make multiple small applications of N fertilizer.\

MP 3.6. Make efficient P fertilizer applications.

MP 3.6.1. When appropriate, apply injected bands of P fertilizer into the soil. P fertilizer is generally more available to the plants if it is injected in bands than if it is applied as a broadcast application.

MP 3.6.2. Apply P fertilizer as close to the time of planting as possible. The longer P fertilizer is in contact with the soil, the less accessible it is to plants.

MP 3.6. When applying manure before you plant a crop, determine the nutrient content and release rate of the manure and the amount of nitrate already present in the soil. Apply manure at a rate consistent with the crop nutrient requirements.

MP 3.7. When possible, avoid water-running N fertilizer in the furrows. If fertilizer N must be water-run, make sure to maximize the uniformity of the irrigation, inject the fertilizer during the last half of the irrigation set, and manage the tailwater.

MP 3.8. Do not apply fertilizer N or surface broadcast P less than 24 hours in advance of a predicted large storm event.

MG 4. Place N fertilizer materials where maximum plant uptake will occur

MP 4.1. Incorporate N fertilizer into the crop bed by placing fertilizer on the seed row and watering it in, by knifing fertilizer into the bed, or by broadcasting fertilizer and then listing it up into the bed.

MG 5. Minimize leaching losses of nitrate during non-crop periods

MP 5.1. If conditions permit, grow a cover crop rather than leave fields fallow during the rainy season.

MP 5.2. Use only low-N fertilizers (such as $N:P_2O_5:K_2O$ equal to 1:3:3) during bed preparation in the fall. Higher N materials may be appropriate if a crop is to be planted soon.

MG 6. Operate irrigation systems to minimize deep percolation and N and P losses (These practices apply to all system types.)

MP 6.1. Monitor soil moisture between irrigations and use that information to guide your irrigation timing decisions.

MP 6.2. Crop need should determine irrigation amount.

MP 6.3. Know the irrigation system flow rates and the time required to apply the desired inches of water.

MP 6.4. Use the minimum leaching fraction that will prevent stand establishment problems or yield reductions from salinity.

MP 6.5. When fertigating with a drip or sprinkler system, run the fertilizer in the later part of the set so as not to leach nutrients beyond the root zone. Avoid fertigating with furrow systems.

MP 6.6. Follow state regulatory requirements and industry guidelines for backflow prevention when injecting fertilizer into irrigation water (CCR Title 3). Schedule regular maintenance of backflow prevention devices.

MP 6.7. If irrigation uniformity remains low after all practical improvements have been made, consider converting to an irrigation system with a greater potential to improve uniformity in a way that minimizes deep percolation.

MP 6.8. Minimize the amount of tailwater leaving the farm during the irrigation season. Even tailwater from fields with only moderate soil nutrient levels can contain significant quantities of N and P that can lead to algal blooms and associated problems.

MG 7. Improve existing furrow irrigation uniformity

MP 7.1. Convert to surge irrigation.

MP 7.2. Where furrow runs are more than 1000 feet long, consider cutting the furrow run length in half with a corresponding decrease in set time.

MP 7.3. Use high irrigation flow rates initially to get water down the furrow and then cut the flow rates back to finish the irrigation.

MP 7.4. Reduce variations in slope when preparing irrigation furrows.

MP 7.5. Use practices that increase irrigation uniformity between furrows (e.g., by using torpedoes in furrows that don't get wheel traffic or by alternating wheel rows with each tractor pass, you can ensure greater uniformity in water advance time in all furrows).

MP 7.6. Recirculate, rechannel, or reuse surface water runoff.

MP 7.7. Keep records on a field-by-field basis of advance and recession times.

MP 7.8. Utilize the services of a mobile irrigation lab.

MG 8. Improve existing sprinkler irrigation uniformity

MP 8.1. Monitor flows and pressure variations throughout the system to detect non-uniform application.

MP 8.2. Maintain the irrigation system by repairing leaks, replacing malfunctioning sprinklers, monitoring nozzle performance for wear, and maintaining adequate water pressure through the entire set.

MP 8.3. Operate sprinklers during the least windy periods, whenever possible. When sprinkler irrigating under windy conditions, reduce the spacing between laterals when possible to optimize application uniformity.

MP 8.4. Use offset lateral moves on successive irrigations to improve distribution uniformity.

MP 8.5. Use flow-control nozzles when the pressure variation throughout the system is excessive.

MP 8.6. Make set times as short as possible during stand establishment.

MP 8.7. For very large blocks, consider converting to linear-move sprinkler systems.

MP 8.8. Utilize the services of a mobile irrigation lab.

MG 9. Improve existing drip irrigation uniformity

MP 9.1. Monitor flows and pressure variations throughout the system to detect non-uniform application.

MP 9.2. Use lateral hose lengths that ensure uniformity.

MP 9.3. Use drip tape that has a small emitter discharge exponent to reduce flow variations that result from pressure differences.

MP 9.4. Check for the potential for emitter clogging by conducting water analysis and fertilizer/water compatibility tests.

MP 9.5. Use filtration, chemical treatments, and flushing as needed to prevent or correct clogging problems.

MP 9.6. Maintain appropriate water pressure throughout the system.

MP 9.7. Utilize the services of a mobile irrigation lab.

MG 10. Evaluate and maintain nutrient management goals and recommended practices

MP 10.1. Periodically evaluate management goals and recommended practices implemented for nutrient management. Correct deficiencies as needed.

REFERENCE

Pettygrove, G. S., S. R. Grattan, B. R. Hanson, T. K. Hartz, L. E. Jackson, T. R. Lockhart, K. F. Schulbach, and R. Smith. 1998. Production guide: Nitrogen and water management for coastal cool-season vegetables. Oakland: University of California Division of Agriculture and Natural Resources, Publication 21581.

FOR MORE INFORMATION

You'll find detailed information on many aspects of field crop production and resource conservation in these titles and in other publications, slide sets, CD-ROMs, and videos from UC ANR:

Nutrients and Water Quality, slide set 90/104

Protecting Groundwater Quality in Citrus Production, publication 21521

Sediments and Water Quality, slide set 91/102

To order these products, visit our online catalog at http://anrcatalog.ucdavis.edu. You can also place orders by mail, phone, or FAX, or request a printed catalog of publications, slide sets, CD-ROMs, and videos from

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UC PEER REVIEWED

This publication has been anonymously peer reviewed for technical accuracy by University of California scientists and other qualified professionals. This review process was managed by the ANR Associate Editor for Natural Resources.

Site Assessment and Practices Planning–Sediment, cont'd.

	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Vegetation is established along field edges to shield from wind									
Herbaceous Wind Barrier #603									
Windbreak/Shelterbelt #380 & #650									
Irrigations are ended if significant runoff occurs									
Cover crops are used to enhance soil aggregate structure and improve infiltration									
Cover Crop #340									

Site Assessment and Practices Planning–Sediment, cont'd.

15. Are some areas drip irrigated?
☐ **Yes** ☐ **No**

Notes:

Improve Drip Irrigation Uniformity									
	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Drip tape and emitters are used with an application rate that matches system design, soil or substrate type, and crop needs									
The water supply is evaluated for high bicarbonates that can cause clogging									
A filter is selected that filters the mineral and sand particles in the water supply									
Filters are regularly flushed/cleaned									
Lateral lines are flushed regularly									
Lateral lines are periodically chlorinated to prevent bacterial and algal build-up and root intrusion into emitters									
Emitters are regularly checked to ensure they are delivering water to plants									
Leaks on mains and laterals are repaired									
Emitters with shut-off valves to isolate unused containers or benches are used									
Drip tape with a small emitter discharge exponent is used									
Pulse irrigation is used									
A pressure regulator is used for each submain									
Pressures of submains are regularly adjusted									
Pressure compensating emitters are used									
Cover crops are used to enhance soil aggregate structure and improve infiltration									
Cover Crop #340									

Site Assessment and Practices Planning–Sediment, cont'd.

Managing Pesticides

Pesticides that move from their site of application into surface or groundwater can affect the beneficial uses of water through their potential impact on human and animal health, and on non-target organisms. Wind and water erosion of soil, or drift from pesticide applications may contribute to pesticide movement away from the target area. Pesticides may enter surface waters in irrigation return flows and tile drainage either as water-soluble residuals or adsorbed to sediments. Groundwaters in agricultural areas may also be subject to pollution from pesticides when deep percolation from irrigated land carries water-soluble pesticides to the groundwater. Many practices in this section fall under NRCS Conservation Practice Standard Pest Management #595. Consult other sources such as the UC Integrated Pest Management (IPM) Pest Management Guidelines for crop-specific IPM practices and alternatives to pesticide use http://www.ipm.ucdavis.edu.

Pesticide Management Program

P1. Does your pest management program have the potential to impact water quality?
☐ Yes ☐ No

Notes:

Use IPM to Make Informed Pesticide Management Decisions
http://www.imp.ucdavis.edu

	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Prepare Site and Use Plant Materials to Promote Crop Health									
Fields are designed or managed to reduce water related stress									
Bedding #310									
Irrigation Land Leveling #464									
Irrigation Water Management #449									
Container media is selected to reduce water related stress									
Resistant varieties are planted									
Crop rotations are used to break pest population cycles									
Conservation Crop Rotation #328									
Cover crops are used to promote soil health and reduce weeds, insects, and pathogens									
Cover Crops #340									
Non-cropped areas are managed (planted, paved or mulched) to discourage weeds									

Site Assessment and Practices Planning–Sediment, cont'd.

	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Assess Pest Populations									
UC IPM Pest Management Guidelines are consulted for crop-specific assessment techniques http://www.ipm.ucdavis.edu									
Blocks are scouted regularly for early detection of pests and diseases									
"Hot spots" are identified									
Records of pests and beneficial insects are maintained									
Adopt Cultural Practices for Pest Management									
Sanitation - Plant material is certified and inspected for vigor, sanitation is practiced when handling plant material and equipment									
Pest-ridden and diseased plants are removed or rogued out									
Alternate host plants that are non-native and/or not harboring beneficial insects are replaced									
Dust from roads onto fields is reduced by mulching graveling, watering down, or treating with an environmentally safe dust suppressant									
Access Road #560									
Mulching #484									
Mechanical weeding such as mowing, tilling, disking, and hand weeding is used whenever practical									
Physical or environmental controls are used (changing humidity or temperature in greenhouses, switching to drip irrigation in row crops, etc.)									
Pest exclusion is performed in greenhouses									

Site Assessment and Practices Planning–Sediment, cont'd.

	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Adopt Biological Control Practices for Pest Management									
Biological controls are used to control pest populations, where possible									
Populations of beneficial insects are considered when making pesticide selection									
Make Efficient Pest Control Decisions									
UC IPM Pest Management Guidelines are consulted for alternatives to chemical pest control, or for reduced risk pesticide selections. http://www.ipm.ucdavis.edu									
Compatible pesticides such as selective pesticides are used when beneficial insects are present									
Application decisions are based on scouting data, pest thresholds and/or risk assessment models									
Pesticides are selected for lower risk of runoff or leaching based upon site conditions, pesticide label warnings, or transport models www.wcc.nrcs.usda.gov/pestmgt/winpst.html									
"Hot spots" are treated independently									
Pesticides are applied at the lowest effective labeled rate									

Site Assessment and Practices Planning–Sediment, cont'd.

Pesticide Handling

P2. Are pesticides stored on site?
☐ Yes ☐ No

Notes:

P3. Are pesticides mixed and loaded on site?
☐ Yes ☐ No

Notes:

P4. Are pesticides (organic and/or synthetic) applied to crops, including ground applied, foliar applied, and chemigation?
☐ Yes ☐ No

Notes:

Implement Responsible Storage Application and Disposal Practices									
	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Handle Materials Safely									
Pesticide handlers and applicators receive yearly training									
Pesticide label instructions and environmental hazard warnings are followed									
Application equipment and/or injectors are checked and calibrated regularly									
Acreage to be treated and soil types are known									
Pesticides sprayers are turned off when equipment is making turns outside of rows									
Pesticides are not sprayed when winds could move pesticides off-target as 'drift'									
Greenhouse exhaust fans are turned off during applications									
Rain events are considered – pesticides are not applied prior to projected rain events									

Site Assessment and Practices Planning–Sediment, cont'd.

	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Pesticide applications in ditches occur when water quality impacts are minimal and materials are used that are approved for use near aquatic habitat									
Disposal methods are environmentally safe									
Design Facilities Appropriately									
The pesticide storage facility includes a concrete pad and curb to contain spills and leaks									
Production wells are located on elevated, impervious bases and are upslope of pesticide storage and handling facilities									
Wellhead protection consists of an impermeable pad, sump or buffer area of 100′ around the wellhead that excludes pesticide handling and pesticide laden drainage									
Containment basins are lined to prevent leaching of pesticides									
Mixing is performed on low runoff hazard sites – over 100 feet downslope of wells on an impermeable surface									
Agrichemical Handling Facility # 702									

Site Assessment and Practices Planning–Sediment, cont'd.

Reducing Pesticide Movement

P5. Do the pesticides applied to your crops have the potential to move offsite adsorbed to sediment, in runoff water and/or by leaching?
☐ Yes ☐ No

Notes:

P6. Are you aware of pesticides in the soil from historic applications?
☐ Yes ☐ No

Notes:

Reduce Pesticide Movement with Water and Eroding Soil									
	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Design Field Layout to Minimize Pesticide Movement									
The field is shaped to planned grades									
Irrigation Land Leveling #464									
Land Smoothing #466									
Rows are placed on slopes, grades, widths, or on the contour to minimize erosion and runoff									
Contour Farming #330									
Contour Orchard and other Fruit Area #331									
Row Arrangement #557									
Manage Field to Reduce Pesticide Movement									
Bare soil in the field has been covered with vegetation to reduce soil erosion, increase infiltration and build soil organic matter									
Conservation Cover #327									
Cover Crop #340									
Vegetative Barrier #601									

Site Assessment and Practices Planning–Sediment, cont'd.

	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Plant residues are retained or other materials are applied to the soil or substrate surface									
Mulching #484									
Residue Management #329									
Deep tillage is performed to fracture restrictive soil layers and increase deep percolation where leaching of pollutants to groundwater is not a significant risk									
Deep Tillage #324									
Irrigations are managed to minimize leaching and runoff									
Irrigation Water Management #449									
Strips of perennial vegetation are placed along rows farmed on the contour									
Contour Buffer Strip #332									
A structure to collect sediment containing pesticides is installed and maintained									
Sediment Basin #350									
Water and Sediment Control Basin #638									
Irrigation System, Tailwater Recovery #447									
Vegetation is established along the downslope field edge to filter sediment containing pesticides									
Conservation Cover #327									
Filter Strip #393									
A vegetated channel is placed downslope of the field									
Grassed Waterway #412									

Site Assessment and Practices Planning–Sediment, cont'd.

Managing Nutrients

Nutrient sources associated with agricultural production practices include fertilizers and other amendments, nutrients in groundwater used in irrigation, biodegradation of crop residues, agricultural and municipal waste applied to land, and waste generated by animals directly. Nutrients from these sources become pollutants when they are transported offsite into nearby streams and lakes or percolate in excessive amounts to groundwater. Nitrates and phosphates in surface water bodies contribute to eutrophication. Eutrophication leads to increases in aquatic plants and algal blooms that deplete dissolved oxygen, impacting aquatic organisms. Nitrate pollution of groundwater is widespread and a serious problem statewide because of impacts to drinking water. Nitrates are water-soluble and have the potential to leach or to run off in surface water. Phosphates attach to soil particles and have the potential to move offsite with eroding soil. In areas with high concentrations of accumulated soil phosphorus, phosphorus can also be carried off as dissolved phosphate in runoff water. Many practices in this section fall under NRCS Conservation Practice Standard Nutrient Management #590.

Nutrient Management Program

N1. Do you apply sources of nitrogen (N) and/or phosphorus (P) (fertilizer, compost, manure)?
☐ Yes ☐ No

Notes:

Make Informed Nutrient Management Decisions									
	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Base Fertilizer Use on Crop Needs									
N and P requirements are determined for each crop									
N and P status of soil amendments or substrate is determined									
Well/irrigation water is monitored for N and P levels									
Pre sidedress nitrogen testing is used where applicable									
Tissue samples are taken for N and P status									
All N and P sources (irrigation water, amendments, crop residue, etc.) are considered in a nutrient budget									
Use a nutrient budget in determining fertilizer applications									

Site Assessment and Practices Planning–Sediment, cont'd.

	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Make Efficient Fertilizer Decisions									
Fertilizer application is timed according to crop requirements									
Fertigation is used									
Split applications are made									
A controlled/slow release fertilizer is used alone or with a liquid feed									
Nitrogen accumulating species are used for cover cropping									
Cover Crop #340									
Irrigations are managed to avoid nutrient loss below the rootzone									
Irrigation Water Management #449									

Site Assessment and Practices Planning–Sediment, cont'd.

Nutrient Handling

N2. Are fertilizers stored and/or mixed on site?
☐ Yes ☐ No

Notes:

N3. Are fertilizers (organic and/or synthetic) applied to crops, including pre-mixing with soil substrates, ground applied, foliar applied, and fertigation?
☐ Yes ☐ No

Notes:

Implement Responsible Storage, Application, and Disposal Practices									
	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Handle Materials Safely									
Application equipment and/or injectors are checked and calibrated regularly									
Precision placement is used to apply fertilizer close to roots									
Fertilizer handlers and applicators receive training									
Rain and irrigation events are considered – Fertilizers are not applied prior to projected rain events or irrigations									
Design Facilities Appropriately									
The fertilizer storage facility includes a concrete pad and curb to contain spills and leaks									
Mixing is performed on low runoff hazard sites – over 100 feet downslope of the well on an impermeable surface									
Agrichemical Handling Facility #702									

Site Assessment and Practices Planning–Sediment, cont'd.

Reducing Nutrient Movement

N4. Does the fertilizer applied to your crops have the potential to move offsite attached to sediment, in runoff water or by leaching?
☐ Yes ☐ No

Notes:

Reduce Nutrient Movement with Water and Eroding Soil									
	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Field Layout									
The field is shaped to planned grades									
Irrigation Land Leveling #464									
Land Smoothing #466									
Rows are placed on slopes, grades, widths or on the contour to minimize erosion and runoff									
Contour Farming #330									
Contour Orchard and other Fruit Area #331									
Row Arrangement #557									
Plants in poorly drained soil are placed on parallel ridges or 'beds'									
Bedding #310									
Manage Field to Reduce Nutrient Movement									
Bare soil in the field has been covered with vegetation to reduce soil erosion, increase infiltration and build soil organic matter									
Conservation Cover #327									
Cover Crop #340									
Vegetative Barrier #601									
Plant residues or other materials are applied to the field soil surface									
Mulching #484									
Residue Management #329									

Site Assessment and Practices Planning–Sediment, cont'd.

	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Deep tillage is performed to fracture restrictive soil layers and increase deep percolation where leaching of pollutants to groundwater is not a significant risk									
Deep Tillage #324									
Irrigations are managed to minimize leaching and runoff									
Irrigation Water Management #449									
Strips of perennial vegetation are placed along rows farmed on the contour									
Contour Buffer Strip #332									
A structure to collect sediment containing nutrients is installed and maintained									
Irrigation System, Tailwater Recovery #447									
Sediment Basin #350									
Water and Sediment Control Basin #638									
Vegetation is established along the downslope field edge to filter sediment containing nutrients									
Conservation Cover #327									
Filter Strip #393									
Vegetation is placed downslope of the field									
Grassed Waterway #412									
Constructed Wetland #656									

Site Assessment and Practices Planning–Sediment, cont'd.

Nutrient Waste

N5. Is there a septic system on the farm or operation?
☐ Yes ☐ No

Notes:

N6. Do livestock have access to a waterbody?
☐ Yes ☐ No

Notes:

N7. Is there a feedlot, loafing area, or concentration of livestock near a waterbody?
☐ Yes ☐ No

Notes:

Reduce Nutrient Pollution from Human and/or Livestock Waste									
	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Septic systems are inspected and maintained									
Portable toilets are regularly maintained to avoid spills									
Livestock are fenced off from waterways									
Fence #382									
Use Exclusion #472									
Livestock are directed away from waterbodies with placement of troughs, salt licks, dusters and/or trails.									
Animal Trails or Walkways #575									
Prescribed Grazing #528									
Watering Facility #614									

Site Assessment and Practices Planning–Sediment, cont'd.

Managing Salinity

Irrigation water is essential for crop production in the arid and semiarid regions of California. Irrigation water naturally contains a certain amount of dissolved minerals (salts) depending on its source. Typical irrigation water contains a substantial amount of salt. For example a water source with an EC of 1.0 mmho/cm, a quality suitable for irrigation of most crops, contains nearly a ton of salt in every ac-foot of water applied. In some coastal areas, increased groundwater pumping has resulted in salt water intrusion from the ocean, threatening the overall groundwater quality. In areas such as the Salinas Basin, surface water quality degradation of ponds and sloughs has resulted from high salt levels in irrigation return flow.

Salinity Management Program

1. Is salt accumulation from irrigation, fertilizer, and/or amendments a potential problem?
☐ **Yes** ☐ **No**

Notes:

Manage Soil Salinity									
	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Manage Salinity from Irrigation Water									
The salinity of irrigation water is evaluated									
The distribution uniformity of the irrigation system is improved or maintained									
Appropriate leaching fractions are used									
Fields are graded to improve irrigation uniformity									
Irrigation Land Leveling #464									
Saline wells are decommissioned and alternative water supplies are used									
Well Decommissioning #351									
Manage Salinity from Fertilizers and Amendments									
Fertilizers and amendments that have a low salt index are used									

Site Assessment and Practices Planning–Sediment, cont'd.

	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Manage Saline Soils									
Soil salinity is evaluated									
Gypsum and other calcium containing amendments to reduce the build-up of exchangeable sodium (ESP) are used									
Sulfur amendments are used to reduce soil pH									
Where leaching of pollutants to groundwater is not a significant risk, deep tillage is used to break-up hardpan layers that prevent salts from leaching									
Deep Tillage #324									
A tile drain system is used to improve drainage									
Subsurface Drain #606									
Cover crops are used to improve water infiltration into soil									
Cover Crop #340									
Amendments are used to improve infiltration (PAM, gypsum, organic amendments)									
Anionic Polyacrylamide (PAM) #450									

Site Assessment and Practices Planning–Sediment, cont'd.

Practices to Improve Water Quality in Waterways

Waterways, streams, and riparian areas are sensitive to damage from agricultural, forest and other land use activities and practices. Healthy riparian areas protect farmland from erosion and flooding. They also buffer waterways from the effects of potential nutrient and pesticide runoff.

Land Management Impacts on Waterways

W1. Is there the potential for soil to fall into the waterway or riparian area from cultural operations along the banks (disking, road grading, etc...)?

☐ **Yes** ☐ **No**

Notes:

W2. Are there cattle trails along the waterway and/or do cattle graze in the waterway?

☐ **Yes** ☐ **No**

Notes:

W3. Do you see mud or sediment filling the waterway?

☐ **Yes** ☐ **No**

Notes:

Protect Waterbodies and Riparian Areas

	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Minimize Physical Impacts									
Setbacks are established between cultural operations and waterways.									
Riparian Forest Buffer #391									
Roads have been placed away from waterways.									
Access Road #560									
Livestock access to waterways is controlled with fencing and/or management									
Fence #382									
Prescribed Grazing #528									
Use Exclusion #472									
Watering Facility #614									

Site Assessment and Practices Planning–Sediment, cont'd.

	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Filter Pollutants									
A herbaceous vegetative strip is placed between the operation and waterway to filter out pollutants									
Conservation Cover #327									
Filter Strip #393									
Riparian Herbaceous Cover #390									
Woody vegetation is planted near the natural waterway to filter out pollutants, reduce erosion, and provide wildlife habitat and shade									
Riparian Forest Buffer #391									
Channels carrying water from the farm operations to waterways are planted with vegetation to filter out pollutants									
Grassed Waterway #412									

Site Assessment and Practices Planning–Sediment, cont'd.

Waterway Bank and Channel Management

W4. Is there bare soil along banks and/or are there bank sections that are unstable (i.e. vertical banks) due to inadequate vegetation?
☐ Yes ☐ No

Notes:

W5. Do you notice the waterway depth is eroding or downcutting?
☐ Yes ☐ No

Notes:

W6. Do you notice bank erosion caused by the impacts of bank armoring?
☐ Yes ☐ No

Notes:

W7. Does concentrated runoff entering the waterway result in bank erosion or gullies?
☐ Yes ☐ No

Notes:

Stabilize Banks and Channels									
	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Vegetative cover is established on the banks to reduce erosion and enhance habitat									
Channel Bank Vegetation #322									
Critical Area Planting #342									
Streambank Protection #580									
Obstructions in the waterway are removed to improve water flow and prevent bank erosion									
Clearing and Snagging #326									
The channel bed is stabilized to prevent erosion									
Grade Stabilization Structure #410									
Stream Channel Stabilization #584									

Site Assessment and Practices Planning–Sediment, cont'd.

	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Structures to convey field drainage water into waterways are installed and maintained									
Diversion #362									
Grade Stabilization Structure #410									
Structure for Water Control #587									
Underground Outlet #620									

Site Assessment and Practices Planning–Sediment, cont'd.

Waterway Crossings

W7. Is the waterway crossing prone to washing out?
☐ Yes ☐ No

Notes:

W8. Do you notice channel or bank erosion caused by the impacts of structures such as bridges or crossings?
☐ Yes ☐ No

Notes:

W9. Do your culverts have problems with debris buildup or sediment accumulation?
☐ Yes ☐ No

Notes:

W10. Do you notice water collecting upstream from culvert inlets during storms?
☐ Yes ☐ No

Notes:

W11. Do you see sediment deposited from pooled water above the culvert inlet?
☐ Yes ☐ No

Notes:

W12. Do you see debris deposited upstream of the culvert inlet?
☐ Yes ☐ No

Notes:

W13. Are there high rust lines in any of the metal culvert pipes (this may indicate undersized pipe)?
☐ Yes ☐ No

Notes:

W14. Are any culvert inlet or outlets crushed, torn, jagged or with worn through bases?
☐ Yes ☐ No

Notes:

W15. Is there the potential for water to run down the road when the culvert plugs?
☐ Yes ☐ No

Notes:

Site Assessment and Practices Planning–Sediment, cont'd.

W16. Is the water that comes out of the culvert undercutting the road banik or scouring the channel downstream?
☐ Yes ☐ No

Notes:

Protect Waterway Crossings									
	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Road crossing and culverts have been assessed for proper flows and channel grades									
Access Road #560									
Structure for Water Control #587									
Stream banks are stabilized with vegetation and/or structural measures to reduce erosion									
Channel Vegetation #322									
Critical Area Planting #342									
Streambank Protection #580									
Obstructions are removed to improve water flow and reduce bank erosion									
Clearing and Snagging #326									
Channel crossings and culverts are sized, placed, and maintained to provide a stable channel grade									
Stream Channel Stabilization #584									
Structure for Water Control #587									
Undersized, worn/compacted, or improperly placed culverts are replaced									
Structure for Water Control #587									
Energy dissipaters are installed below culverts to prevent scouring									

Site Assessment and Practices Planning–Sediment, cont'd.

Stream Habitat

W12. Are sections of streamflow exposed to sun for more than half the day?
☐ Yes ☐ No

Notes:

W13. Are there potential impediments to fish passage in the stream?
☐ Yes ☐ No

Notes:

W14. Do you notice the encroachment of non-native invasive plant species and/or the loss of native riparian or wetland habitat?
☐ Yes ☐ No

Notes:

Maintain or Improve Stream Habitat									
	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Vegetative cover is established along banks to reduce erosion and enhance habitat									
Channel Bank Vegetation #322									
Riparian Forest Buffer #391									
Riparian Herbaceous Cover #390									
Tree/Shrub Establishment #612									
Wetland Wildlife Habitat Management #644									
Invasive plant species are identified, removed and replaced with native species									
Restoration and Management of Declining Habitats #643									
Stream conditions are improved for aquatic species									
Irrigation Storage Reservoir #436									
Obstruction Removal #500									
Barriers that restrict or prevent fish migration are removed									
Fish Passage #396									

SELF-EVALUATION

An essential element of a water quality site self-assessment is the tracking of land use and management activities on your agricultural operation. Self-evaluation data that you can provide can be important in explaining any water quality changes that may occur due to implementation of management practices. Self-evaluation techniques can help determine whether water quality changes can be attributed to implementing management practices and not to other confounding influences such as regional geology or a source upstream of the operation.

Simple field measurements are often undervalued and suspected of lacking scientific validity. When properly designed and carefully executed, however, they can provide sound data. Their strength lies in the possibility of taking large numbers of measurements inexpensively and with only semi-skilled assistance to obtain results that are more pertinent to your site than sophisticated measurements taking place at some distant monitoring station.

Record Keeping

Keep with Plan for reference

Do you keep a record of:

- ☐ **weather conditions such as air temperature, precipitation, and evapotranspiration**
- ☐ **extreme weather events such as severe storms, floods, and droughts**
- ☐ **natural vegetation and/or wildlife observations**
- ☐ **grazing (animal numbers, in and out pasture dates)**
- ☐ **natural vegetation and/or wildlife observations**

Photo Point Self-Evaluation

Keep photos and historic records with Plan for reference

Do you have any historic records and/or photographs that can help you document short or long term changes on the farm/ranch? ☐ **Yes** ☐ **No**

How many photo points are on your farm/ranch?

How many times per year will photographs be taken?

Other Self-Evaluation Techniques You Perform or Plan to Perform

Keep with Plan for reference

Technique	Location(s)	Dates or Schedule
Sediments		
☐ Erosion Pins		
☐ Erosion Pipes		
☐ Estimating Streambank Loss		
☐ Imhoff Cones		
☐ Paint Collars		
☐ Sediment Basin or Sand Trap - (record amount of sediment removed)		
☐ Staking Gullies or Streambanks		
☐ Walking the Runoff		
☐		

Self-Evaluation, cont'd.

Nutrients		
☐ Drainage Water Analysis		
☐ Irrigation Water Analysis		
☐ Plant Tissue Analysis		
☐ Record Fertilizer Use		
☐ Soil Analysis		
☐ Utilize Crop Budgets		
☐		
Pesticides		
☐ Monitor for Pests and Beneficial Insects		
☐ Review Use Reports		
☐ Assess Risk of Pesticide Loss		
☐		
Riparian Habitat		
☐ Percent Bare Soil Along Banks		
☐ Percent Canopy Cover over Stream		
☐ Staking Gullies or Streambanks		
☐ Streambank Erosion Measurements		
☐ Walking the Runoff		
☐		
Surface Water Quality		
☐ Ammonia		
☐ Conductivity		
☐ Dissolved Oxygen (DO)		
☐ Nitrate		
☐ pH		
☐ Phoshpates		
☐ Rapid Bioassessment Technique		
☐ Stream Flow		
☐ Stream Temperature		
☐ Stream Turbidity		
☐		

Self-Evaluation, cont'd.

Irrigation/Groundwater Quality		
☐ Electroconductivity (EC)		
☐ Nutrient Levels in Irrigation or Well Water (N, P, Na)		
☐ pH		
☐ Sodium Adsorption Ratio (SAR) or adjusted SAR		
☐ Toxicity Levels in Irrigation water (Sodium, Cl, B)		
☐		
Tailwater/Ditch Drainage Water Quality		
☐ Effluent flow		
☐ Electroconductivity (EC)		
☐ Nutrient Levels in Drainage Water (N, P, Na)		
☐ pH		
☐ Turbidity		
☐		

REFERENCES

Much of the information in the Farm Water Quality Plan has been adapted from the Ranch Water Quality Management Plan created by University of California Cooperative Extension and the USDA Natural Resources Conservation Service (unpublished).

Some practices in the Site Assessment and Practices Planning section were adapted from *Production guide: Nitrogen and water management for coastal cool-season vegetables.* 1998. G. S. Pettygrove, et al., Division of Agriculture and Natural Resources, University of California, Oakland CA; *Farm-A-Syst farmstead assessment system,* University of Wisconsin–Extension http://www.uwex.edu/farmasyst; and *The Positive Points System,* Central Coast Vineyard Team http://www.vineyardteam.org/pps/index.htm.

Numbered practices in the Site Assessment and Practices Planning section refer to USDA–NRCS *National handbook of conservation standards.* Individual practices can be found at http://www.ftw.nrcs.usda.gov/nhcp_2.html.

Site Assessment and Practices Planning questions E7 through E11 adapted from Downie, Scott, Dennis Halligan and Ross Taylor. 1998. *Watershed processes and erosion control: A workbook and compendium.* Fish, Farm, and Forest Communities Forum.

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Farm Water Quality Planning Short Course Objectives, publication 8052

Nonpoint Sources of Pollution in Irrigated Agriculture, publication 8055

Practices for Reducing Nonpoint Source Pollution from Irrigated Agriculture, publication 8075

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Exhibit 12

Ponds — Planning, Design, Construction

United States Department of Agriculture

Natural Resources Conservation Service

Agriculture Handbook Number 590

Preface

This handbook describes the requirements for building a pond. It is useful to the landowner for general information and serves as a reference for the engineer, technician, and contractor.

In fulfilling their obligation to protect the lives and property of citizens, most states and many other government entities have laws, rules, and regulations governing the installation of ponds. Those responsible for planning and designing ponds must comply with all such laws and regulations. The owner is responsible for obtaining permits, performing necessary maintenance, and having the required safety inspections made.

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Agriculture Handbook 590

Ponds — Planning, Design, Construction

Contents

Tables

Figures

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Agriculture Handbook 590

Ponds — Planning, Design, Construction

Introduction

For many years farmers and ranchers have been building ponds for livestock water and for irrigation. By 1980 more than 2.1 million ponds had been built in the United States by land users on privately owned land. More will be needed in the future.

The demand for water has increased tremendously in recent years, and ponds are one of the most reliable and economical sources of water. Ponds are now serving a variety of purposes, including water for livestock and for irrigation, fish production, field and orchard spraying, fire protection, energy conservation, wildlife habitat, recreation, erosion control, and landscape improvement.

This handbook describes embankment and excavated ponds and outlines the requirements for building each. The information comes from the field experience and observation of land users, engineers, conservationists, and other specialists.

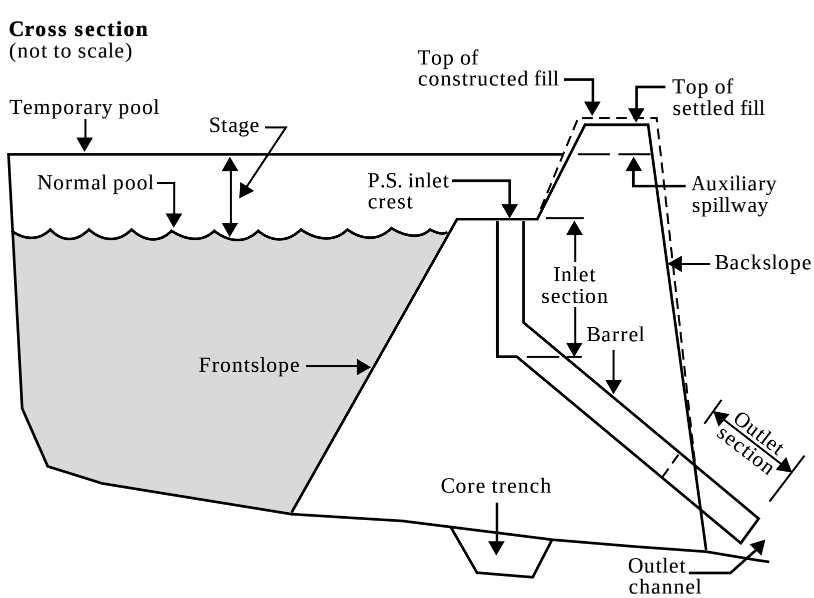
An embankment pond (fig. 1) is made by building an embankment or dam across a stream or watercourse where the stream valley is depressed enough to permit storing 5 feet or more of water. The land slope may range from gentle to steep.

An excavated pond is made by digging a pit or dugout in a nearly level area. Because the water capacity is obtained almost entirely by digging, excavated ponds are used where only a small supply of water is needed. Some ponds are built in gently to moderately sloping areas and the capacity is obtained both by excavating and by building a dam.

The criteria and recommendations are for dams that are less than 35 feet high and located where failure of the structure will not result in loss of life; in damage to homes, commercial or industrial buildings, main highways, or railroads; or in interrupted use of public utilities.

Local information is essential, and land users are encouraged to consult with specialists experienced in planning and building ponds.

Figure 1 Typical embankment and reservoir



Water needs

Livestock

Clean water and ample forage are equally essential for livestock to be finished out in a marketable condition. If stockwater provisions in pasture and range areas are inadequate, grazing will be concentrated near the water and other areas will be undergrazed. This can contribute to serious livestock losses and instability in the livestock industry.

Watering places must also be properly distributed in relation to the available forage. Areas of abundant forage may be underused if water is not accessible to livestock grazing on any part of that area (fig. 2).

Providing enough watering places in pastures encourages more uniform grazing, facilitates pasture improvement practices, retards erosion, and enables farmers to make profitable use of soil-conserving crops and erodible, steep areas unfit for cultivation.

An understanding of stockwater requirements helps in planning a pond large enough to meet the needs of the stock using the surrounding grazing area. The average daily consumption of water by different kinds of livestock shown here is a guide for estimating water needs.

Kind of livestock	Gallons per head per day
Beef cattle and horses	12 to 15
Dairy cows (drinking only)	15
Dairy cows (drinking and barn needs)	35
Hogs	4
Sheep	2

The amount of water consumed at one pond depends on the average daily consumption per animal, number of livestock served, and period over which they are served.

Figure 2 This pond supplies water to a stockwater trough used by cattle in nearby grazing area

Irrigation

Farm ponds are now an important source of irrigation water (fig. 3), particularly in the East, which does not have the organized irrigation enterprises of the West. Before World War II irrigation was not considered necessary in the humid East. Now many farmers in the East are irrigating their crops.

Water requirements for irrigation are greater than those for any other purpose discussed in this handbook. The area irrigated from a farm pond is limited by the amount of water available throughout the growing season. Pond capacity must be adequate to meet crop requirements and to overcome unavoidable water losses. For example, a 3-inch application of water on l acre requires 81,462 gallons. Consequently, irrigation from farm ponds generally is limited to high-value crops on small acreages, usually less than 50 acres.

The required storage capacity of a pond used for irrigation depends on these interrelated factors: water requirements of the crops to be irrigated, effective rainfall expected during the growing season, application efficiency of the irrigation method, losses due to evaporation and seepage, and the expected inflow to the pond. Your local NRCS conservationist can help you estimate the required capacity of your irrigation pond.

Fish production

Many land users are finding that fish production is profitable. A properly built and managed pond can yield from l00 to 300 pounds of fish annually for each acre of water surface. A good fish pond can also provide recreation (fig. 4) and can be an added source of income should you wish to open it to people in the community for a fee.

Ponds that have a surface area of a quarter acre to several acres can be managed for good fish production. Ponds of less than 2 acres are popular because they are less difficult to manage than larger ones. A minimum depth of 8 feet over an area of approximately 1,000 square feet is needed for best management.

Figure 3 Water is pumped out of this pond for irrigation

Field and orchard spraying

You may wish to provide water for applying pesticides to your field and orchard crops. Generally, the amount of water needed for spraying is small, but it must be available when needed. About l00 gallons per acre for each application is enough for most field crops. Orchards, however, may require 1,000 gallons or more per acre for each spraying.

Provide a means of conveying water from the pond to the spray tank. In an embankment pond, place a pipe through the dam and a flexible hose at the downstream end to fill the spray tank by gravity. In an excavated pond, a small pump is needed to fill the tank.

Fire protection

A dependable water supply is needed for fighting fire. If your pond is located close to your house, barn, or other buildings, provide a centrifugal pump with a power unit and a hose long enough to reach all sides of all the buildings. Also provide for one or more dry hydrants (figs. 5 and 6).

Although water-storage requirements for fire protection are not large, the withdrawal rate for fire fighting is high. A satisfactory fire stream should be at least 250 gallons per minute with pressure at the nozzle of at least 50 pounds per square inch. Fire nozzles generally are l inch to 1-1/2 inches in diameter. Use good quality rubber-lined firehoses, 2-1/2 to 3 inches in diameter. Preferably, the hose should be no more than 600 feet long.

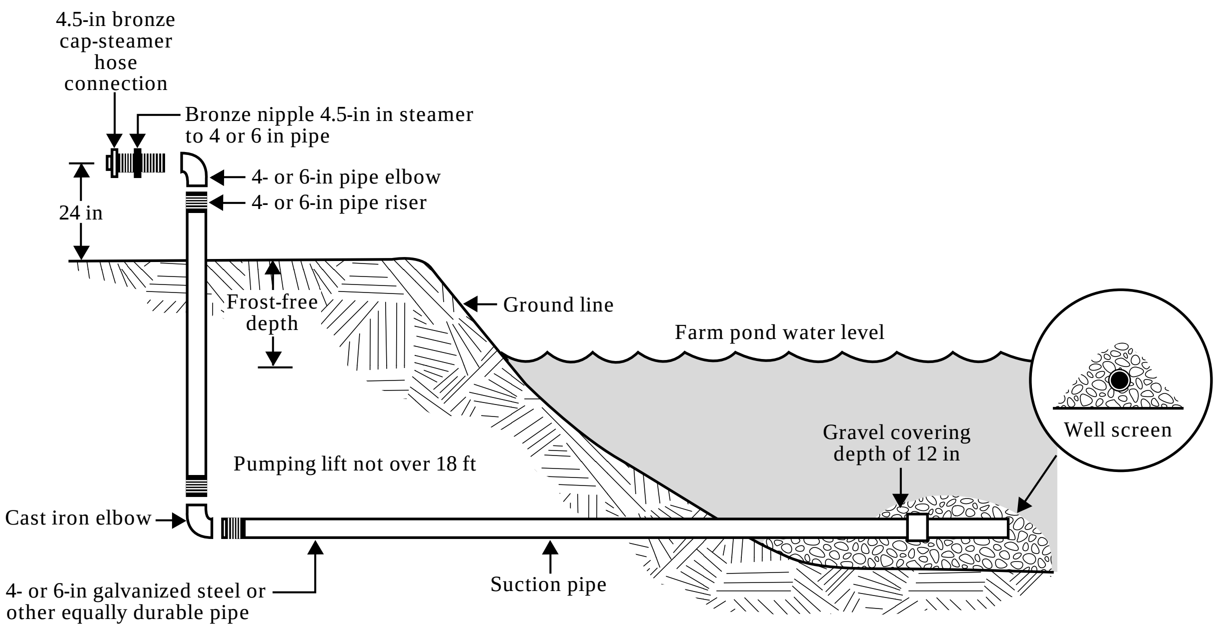
A typical firehose line consists of 500 feet of 3-inch hose and a 1-1/8 inch smooth nozzle. A centrifugal pump operating at 63 pounds per square inch provides a stream of 265 gallons per minute with a nozzle pressure of 50 pounds per square inch. Such a stream running for 5 hours requires 1/4 acre-foot of water. If you live in an area protected by a rural fire fighting organization, provide enough storage to operate several such streams. One acre-foot of storage is enough for four streams.

Your local dealer in pumps, engines, and similar equipment can furnish the information you need about pump size, capacity, and engine horsepower.

Figure 4 A pond stocked with fish can provide recreation as well as profit

Figure 5 A dry hydrant is needed when a pond is close enough to a home or barn to furnish water for fire fighting

Figure 6 Details of a dry hydrant installation



Not to scale

Recreation

A pond can provide many pleasant hours of swimming, boating, and fishing. The surrounding area can be made into an attractive place for picnics and games (fig. 7).

Many land users realize additional income by providing water for public recreation. If the public is invited to use a pond for a fee, the area must be large enough to accommodate several parties engaged in whatever recreation activities are provided.

If a pond is to be used for public recreation, supply enough water to overcome evaporation and seepage losses and to maintain a desirable water level. A pond used for swimming must be free of pollution and have an adequate depth of water near a gently sloping shore. Minimum facilities for public use and safety are also needed. These facilities include access roads, parking areas, boat ramps or docks, fireplaces, picnic tables, drinking water, and sanitary facilities.

To protect public health, most states have laws and regulations that require water supplies to meet certain prescribed standards if they are to be used for swimming and human consumption. Generally, water must be tested and approved before public use is permitted.

There are also rules and regulations for building and maintaining public sanitary facilities. The state board of health or a similar agency administers such laws and regulations. Contact your local health agency to become familiar with those regulations before making extensive plans to provide water for public recreation.

Waterfowl and other wildlife

Ponds attract many kinds of wildlife. Migratory waterfowl often use ponds as resting places in their flights to and from the North. Ducks often use northern ponds as breeding places, particularly where the food supply is ample (fig. 8). Upland game birds use ponds as watering places.

Landscape quality

Water adds variety to a landscape and further enhances its quality. Reflections in water attract the eye and help to create a contrast or focal point in the landscape (fig. 9). A pond visible from a home, patio, or entrance road increases the attractiveness of the landscape and often increases land value. Ponds in rural, suburban, and urban areas help to conserve or improve landscape quality.

Figure 7 Ponds are often used for private as well as public recreation

Figure 8 Waterfowl use ponds as breeding, feeding, watering places, and as resting places during migration

Figure 9 The shoreline of a well-designed pond is protected from erosion by the addition of stone. Such a pond, reflecting nearby trees, increases the value of the surrounding land

Regardless of its purpose, a pond's appearance can be improved by using appropriate principles and techniques of design. Good design includes consideration of size, site visibility, relationship to the surrounding landscape and use patterns, and shoreline configuration.

Your local NRCS conservationist can help you apply the basic principles and design techniques. Consult a landscape architect for additional information and special designs.

Multiple purposes

You may wish to use the water in your pond for more than one purpose; for example, to provide water for livestock, fish production, and spraying field crops. If so, two additional factors must be considered.

First, in estimating your water requirements you must total the amounts needed for each purpose and be sure that you provide a supply adequate for all the intended uses.

Second, make sure that the purposes for which the water is to be used are compatible. Some combinations, such as irrigation and recreation, generally are not compatible. You would probably use most of the water during the irrigation season, making boating and swimming impractical.

Ponds used temporarily for grade control or as sediment basins associated with construction sites can be converted later into permanent ponds by cleaning out the sediment, treating the shoreline, and adding landscape measures (fig. 10). If a sediment basin is to be cleaned and reconstructed as a water element, the standards for dam design should be used.

Figure 10 This pond, which served as a sediment basin while homes in the background were being constructed, now adds variety and value to the community

Preliminary investigations

General considerations

Selecting a suitable site for your pond is important, and preliminary studies are needed before final design and construction. Analysis and selection of pond sites should be based on landscape structure and associated ecological functions and values. Relationship of the site to other ecological features within the landscape is critical to achieving planned objectives. If possible, consider more than one location and study each one to select the most ecologically appropriate, esthetic, and practical site. Weighing both onsite and offsite effects of constructing a pond is essential in site selection. Refer to figure 1 and the glossary to become familiar with the components of a pond and associated dam.

For economy, locate the pond where the largest storage volume can be obtained with the least amount of earthfill. A good site generally is one where a dam can be built across a narrow section of a valley, the side slopes are steep, and the slope of the valley floor permits a large area to be flooded. Such sites also minimize the area of shallow water. Avoid large areas of shallow water because of excessive evaporation and the growth of noxious aquatic plants.

If farm ponds are used for watering livestock, make a pond available in or near each pasture or grazing unit. Forcing livestock to travel long distances to water is detrimental to both the livestock and the grazing area. Space watering places so that livestock does not travel more than a quarter mile to reach a pond in rough, broken country or more than a mile in smooth, nearly level areas. Well-spaced watering places encourage uniform grazing and facilitate grassland management.

If pond water must be conveyed for use elsewhere, such as for irrigation or fire protection, locate the pond as close to the major water use as practicable. Conveying water is expensive and, if distance is excessive, the intended use of the water may not be practical.

Ponds for fishing, boating, swimming, or other forms of recreation must be reached easily by automobile, especially if the general public is charged a fee to use the pond. The success of an income-producing recreation enterprise often depends on accessibility.

Avoid pollution of pond water by selecting a location where drainage from farmsteads, feedlots, corrals, sewage lines, mine dumps, and similar areas does not reach the pond. Use permanent or temporary measures, such as diversions, to redirect runoff from these sources to an appropriate outlet until the areas can be treated.

Do not overlook the possibility of failure of the dam and the resulting damage from sudden release of water. Do not locate your pond where failure of the dam could cause loss of life; injury to persons or livestock; damage to homes, industrial buildings, railroads, or highways; or interrupted use of public utilities. If the only suitable pond site presents one or more of these hazards, hire a qualified person to investigate other potential sites to reduce the possibility of failure from improper design or construction.

Be sure that no buried pipelines or cables cross a proposed pond site. They could be broken or punctured by the excavating equipment, which can result not only in damage to the utility, but also in injury to the operator of the equipment. If a site crossed by pipelines or cable must be used, you must notify the utility company before starting construction and obtain permission to excavate.

Avoid sites under powerlines. The wires may be within reach of a fishing rod held by someone fishing from the top of the dam.

Area adequacy of the drainage

For ponds where surface runoff is the main source of water, the contributing drainage area must be large enough to maintain water in the pond during droughts. However, the drainage area should not be so large that expensive overflow structures are needed to bypass excess runoff during large storms.

The amount of runoff that can be expected annually from a given watershed depends on so many interrelated factors that no set rule can be given for its determination. The physical characteristics that directly affect the yield of water are relief, soil infiltration, plant cover, and surface storage. Storm characteristics, such as amount, intensity, and duration of rainfall, also affect water yield. These characteristics vary widely throughout the United States. Each must be considered when evaluating the watershed area conditions for a particular pond site.

Figure 11 is a general guide for estimating the approximate size of drainage area needed for a desired water-storage capacity. For example, a pond located in west-central Kansas with a capacity of 5 acre-feet requires a drainage area of at least 175 acres under normal conditions. If reliable local runoff information is available, use it in preference to the guide.

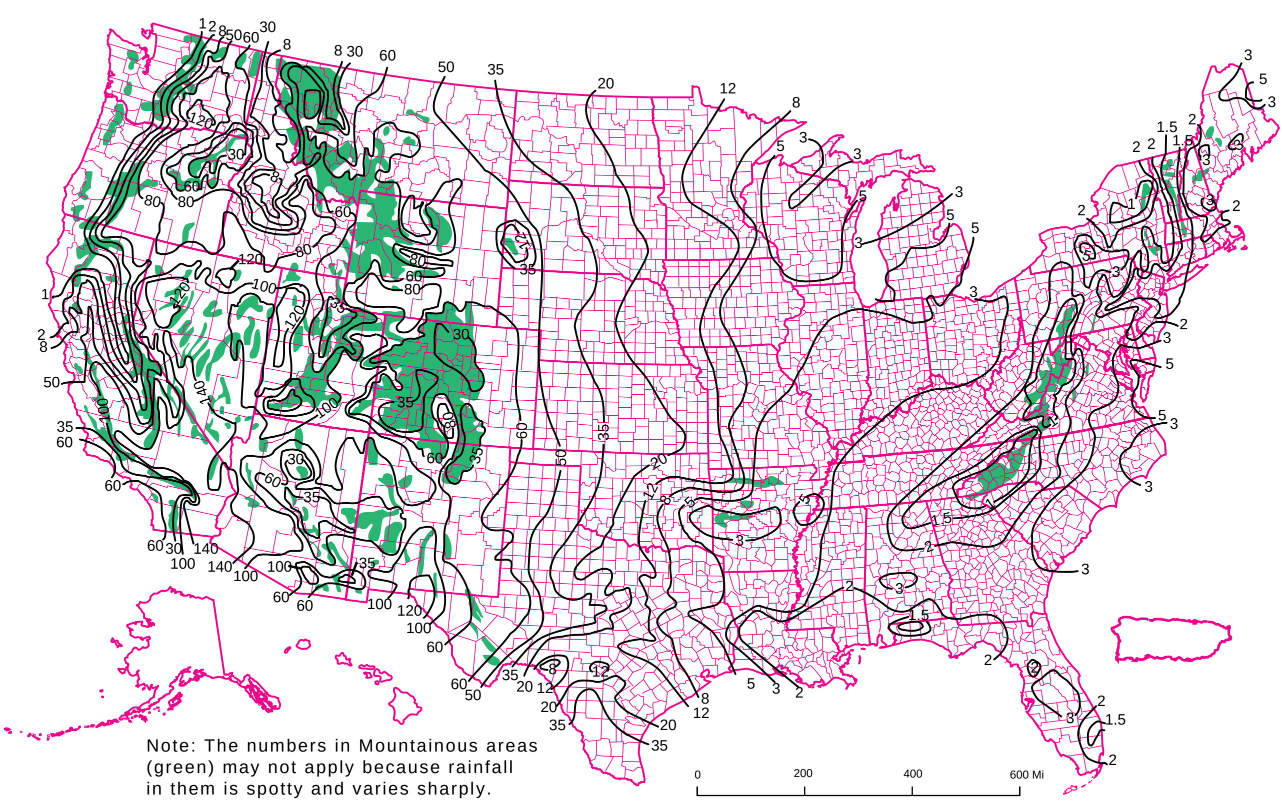
Average physical conditions in the area are assumed to be the normal runoff-producing characteristics for a drainage area, such as moderate slopes, normal soil infiltration, fair to good plant cover, and normal surface storage.

To apply the information given in figure 11, some adjustments may be necessary to meet local conditions. Modify the values in the figure for drainage areas having characteristics other than normal. Reduce the values by as much as 25 percent for drainage areas having extreme runoff-producing characteristics. Increase them by 50 percent or more for low runoff-producing characteristics.

Minimum pond depth

To ensure a permanent water supply, the water must be deep enough to meet the intended use requirements and to offset probable seepage and evaporation losses. These vary in different sections of the country and from year to year in any one section. Figure 12 shows the recommended minimum depth of water for ponds if seepage and evaporation losses are normal. Deeper ponds are needed where a permanent or year-round water supply is essential or where seepage losses exceed 3 inches per month.

Figure 11 A guide for estimating the approximate size of a drainage area (in acres) required for each acre-foot of storage in an embankment or excavated pond



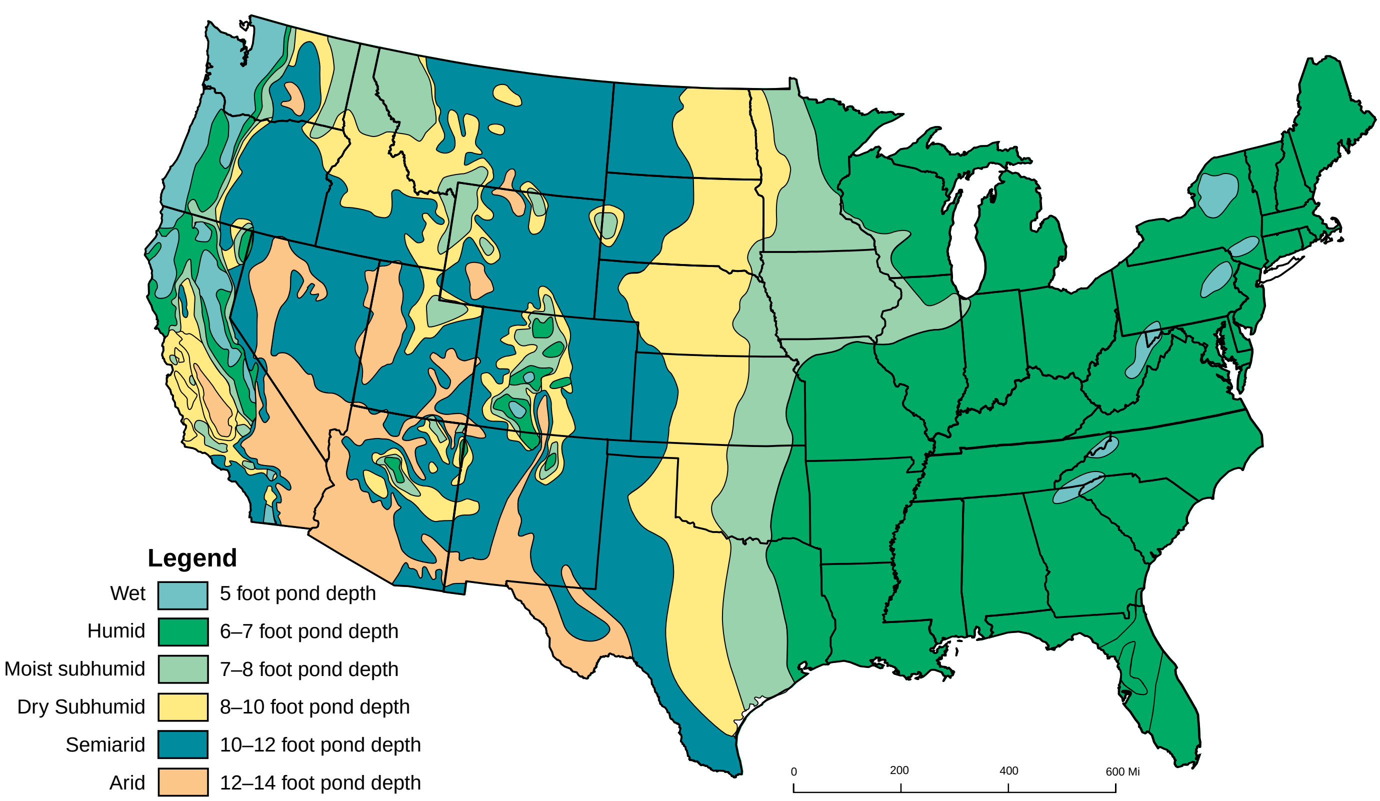
Drainage area protection

To maintain the required depth and capacity of a pond, the inflow must be reasonably free of silt from an eroding watershed. The best protection is adequate application and maintenance of erosion control practices on the contributing drainage area. Land under permanent cover of trees, grass, or forbs is the most desirable drainage area (fig. 13). Cultivated areas protected by conservation practices, such as terraces, conservation tillage, stripcropping, or conservation cropping systems, are the next best watershed conditions.

If an eroding or inadequately protected watershed must be used to supply pond water, delay pond construction until conservation practices are established. In any event, protection of the drainage area should be started as soon as you decide to build a pond.

Figure 13 Land with permanent vegetation makes the most desirable drainage area

Figure 12 Recommended minimum depth of water for ponds in the United States



Pond capacity

Estimate pond capacity to be sure that enough water is stored in the pond to satisfy the intended use requirements. A simple method follows:

- Establish the normal pond-full water elevation and stake the waterline at this elevation.
- Measure the width of the valley at this elevation at regular intervals and use these measurements to compute the pond-full surface area in acres.
- Multiply the surface area by 0.4 times the maximum water depth in feet measured at the dam.

For example, a pond with a surface area of 3.2 acres and a depth of 12.5 feet at the dam has an approximate capacity of 16 acre-feet (0.4 x 3.2 x 12.5 = 16 acre-feet) [1 acre-foot = 325,651 gallons].

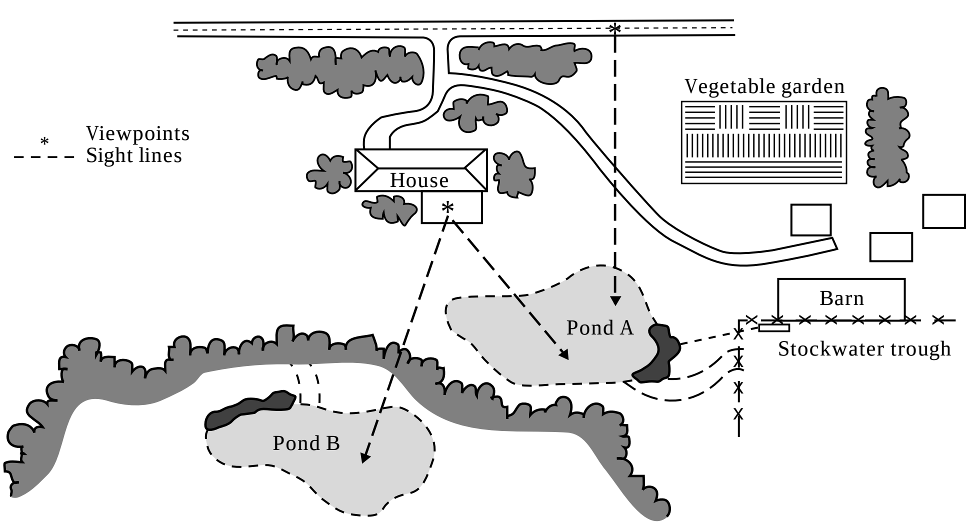
Landscape evaluation

Alternative pond sites should be evaluated for potential visibility and compatibility with surrounding landscape characteristics and use patterns (fig. 14). Identify major viewpoints (points from which the site is viewed) and draw the important sight lines with cross sections, where needed, to determine visibility. If feasible, locate the pond so that the major sight line crosses the longest dimension of water surface. The pond should be placed so that a viewer will see the water first before noticing the dam, pipe inlet, or spillway. Often, minor changes in the dam alignment and spillway location can shift these elements out of view and reduce their prominence.

If possible, locate your pond so that some existing trees and shrubs remain along part of the shoreline. Vegetation adds aesthetic value by casting reflections on the water, provides shade on summer days, and helps blend the pond into the surrounding landscape. A pond can often be located and designed so that an island is created for recreation, wildlife habitat, or visual interest.

In addition to the more typical farm and residential sites, ponds can be located on poor quality landscapes to rehabilitate abandoned road borrow areas, dumping sites, abandoned rural mines, and other low production areas.

Figure 14 A preliminary study of two alternative sites for a pond to be used for livestock water, irrigation, and recreation



Estimating storm runoff

The amount of precipitation, whether it occurs as rain or snow, is the potential source of water that may run off small watersheds. The kind of soil and the type of vegetation affect the amount of water that runs off. Terraces and diversions, along with steepness and shape of a watershed, affect the rate at which water runs off.

A spillway is provided to bypass surface runoff after the pond is filled. The tables and charts in the following sections should be used to estimate the peak discharge rates for the spillway. They provide a quick and reliable estimate of runoff rates and associated volumes for a range of storm rainfall amounts, soil groups, land use, cover conditions, and watershed slopes.

Hydrologic groupings of soils

Soils are classified in four hydrologic groups according to infiltration and transmission rates:

A—These soils have a high infiltration rate. They are chiefly deep, well-drained sand or gravel. The runoff potential is low.

B—These soils have a moderate infiltration rate when thoroughly wet. They are chiefly moderately deep, well-drained soils of moderately fine to moderately coarse texture.

C—These soils have a slow infiltration rate when wet. These moderately fine to fine texture soils have a layer that impedes downward movement of water.

D—These soils have a very slow infiltration rate. They are chiefly clay soils that have a high swelling potential, soils with a permanent high water table, soils with a claypan at or near the surface, and shallow soils over nearly impervious material. The runoff potential is high.

The NRCS district conservationist or your county extension agent can help you classify the soils for a given pond site in one of the four hydrologic groups.

Runoff curve numbers

Tables 1 through 4 show numerical runoff ratings for a range of soil-use-cover complexes. Because these numbers relate to a set of curves developed from the NRCS runoff equation, they are referred to as curve numbers (CN) in these tables.

The watershed upstream from a farm pond often contains areas represented by different curve numbers. A weighted curve number can be obtained based on the percentage of area for each curve number. For example, assume that the watershed above a pond is mainly (three-fourths) in good pasture and a soil in hydrologic group B. The remainder is cultivated with conservation treatment on a soil in hydrologic group C.

A weighted curve number for the total watershed would be:

3/4 x 61	=	46 (approximately)
1/4 x 76	=	20 (approximately)
Weighted	=	66

Table 1 Runoff curve numbers for urban areas [1/]

Cover description	Average percent impervious area [2/]	Curve numbers for hydrologic soil group A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3/]					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50 to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4/]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5/]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 3)					

1/ Average runoff condition, and $I_a = 0.2S$.

2/ The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4 in NRCS Technical Release 55, Urban Hydrology for Small Watersheds.

3/ CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

4/ Composite CN's for natural desert landscaping should be computed using figure 2-3 or 2-4 in Technical Release 55, based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

5/ Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 in Technical Release 55, based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Table 2 Runoff curve numbers for agricultural lands [1/]

Cover description			Curve numbers for hydrologic soil group			
Cover type	Treatment [2/]	Hydrologic condition [3/]	A	B	C	D
Fallow	Bare soil	—	77	86	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured & terraced (C&T)	Poor	66	74	80	82
		Good	62	71	78	81
	C&T + CR	Poor	65	73	79	81
		Good	61	70	77	80
Small grain	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
	C&T	Poor	61	72	79	82
		Good	59	70	78	81
	C&T + CR	Poor	60	71	78	81
		Good	58	69	77	80
Closed-seeded or broadcast legumes or rotation meadow	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

1/ Average runoff condition, and $I_a = 0.2S$.
2/ Crop residue cover applies only if residue is on at least 5 percent of the surface throughout the year.
3/ Hydrologic condition is based on combination of factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes in rotations, (d) percentage of residue cover on the land surface (good > 20%), and (e) degree of surface roughness.
Poor: Factors impair infiltration and tend to increase runoff.
Good: Factors encourage average and better than average infiltration and tend to decrease runoff.

Table 3 Runoff curve numbers for other agricultural lands 1/

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition 3/	A	B	C	D
Pasture, grassland, or range—continuous grazing 2/	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element 3/	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 4/	48	65	73
Woods—grass combination (orchard or tree farm) 5/	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods 6/	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 4/	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

1/ Average runoff condition, and I_a = 0.2S.
2/ Poor: <50% ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: >75% ground cover and lightly or only occasionally grazed.
3/ Poor: <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.
4/ Actual curve number is less than 30; use CN = 30 for runoff computations.
5/ CN's shown were computed for areas with 50% woods and 505 grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.
6/ Poor: Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Table 4 Runoff curve numbers for arid and semiarid rangelands 1/

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition 2/	A 3/	B	C	D
Herbaceous—mixture of grass, forbs, and low-growing brush, with brush the minor element	Poor	—	80	87	93
	Fair	—	71	81	89
	Good	—	62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor	—	66	74	79
	Fair	—	48	57	63
	Good	—	30	41	48
Pinyon-juniper—pinyon, juniper, or both grass understory	Poor	—	75	85	89
	Fair	—	58	73	80
	Good	—	41	61	71
Sagebrush with grass understory	Poor	—	67	80	85
	Fair	—	51	63	70
	Good	—	35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

1/ Average runoff condition, and I_a = 0.2S. For range in humid regions, use table 3.
2/ Poor: <30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: >70% ground cover.
3/ Curve numbers for group A have been developed only for desert shrub.

Volume of storm runoff

Often knowing how much water runs off from a big storm as well as the rate at which it flows is good. The volume is needed to compute needed storage as well as the peak discharge rate.

The figures in table 5 are the depth (in inches) at which the storm runoff, if spread evenly, would cover the entire watershed. For example, the volume of runoff from a 3-inch rainfall on a 100-acre watershed with the weighted curve number of 66 would be:

0.55 inch (interpolated between 0.51 and 0.72 inches)
100 acres x 0.55 inch = 55 acre-inches
55 acre-inches ÷12 = 4.55 acre-feet
55 acre-inches x 27,152 gallons per acre-inch = 1.5 million gallons (approximately)

Table 5 Runoff depth, in inches

Rainfall (inches)	Curve number 60	65	70	75	80	85	90
1.0	0	0	0	0.03	0.08	0.17	0.32
1.2	0	0	0.03	0.07	0.15	0.28	0.46
1.4	0	0.02	0.06	0.13	0.24	0.39	0.61
1.6	0.01	0.05	0.11	0.20	0.34	0.52	0.76
1.8	0.03	0.09	0.17	0.29	0.44	0.65	0.93
2.0	0.06	0.14	0.24	0.38	0.56	0.80	1.09
2.5	0.17	0.30	0.46	0.65	0.89	1.18	1.53
3.0	0.33	0.51	0.72	0.96	1.25	1.59	1.98
4.0	0.76	1.03	1.33	1.67	2.04	2.46	2.92
5.0	1.30	1.65	2.04	2.45	2.89	3.37	3.88
6.0	1.92	2.35	2.87	3.28	3.78	4.31	4.85
7.0	2.60	3.10	3.62	4.15	4.69	5.26	5.82
8.0	3.33	3.90	4.47	5.04	5.62	6.22	6.81
9.0	4.10	4.72	5.34	5.95	6.57	7.19	7.79
10.0	4.90	5.57	6.23	6.88	7.52	8.16	8.78
11.0	5.72	6.44	7.13	7.82	8.48	9.14	9.77
12.0	6.56	7.32	8.05	8.76	9.45	10.12	10.76

Rainfall amounts and expected frequency

Maps in U.S. Weather Bureau Technical Paper 40 (USWP-TP-40), Rainfall Frequency Atlas of the United States, show the amount of rainfall expected in a 24-hour period. These maps have also been reprinted in Hydrology for Small Urban Watershed, Technical Release 55. Contact your local NRCS field office for rainfall amounts on maps.

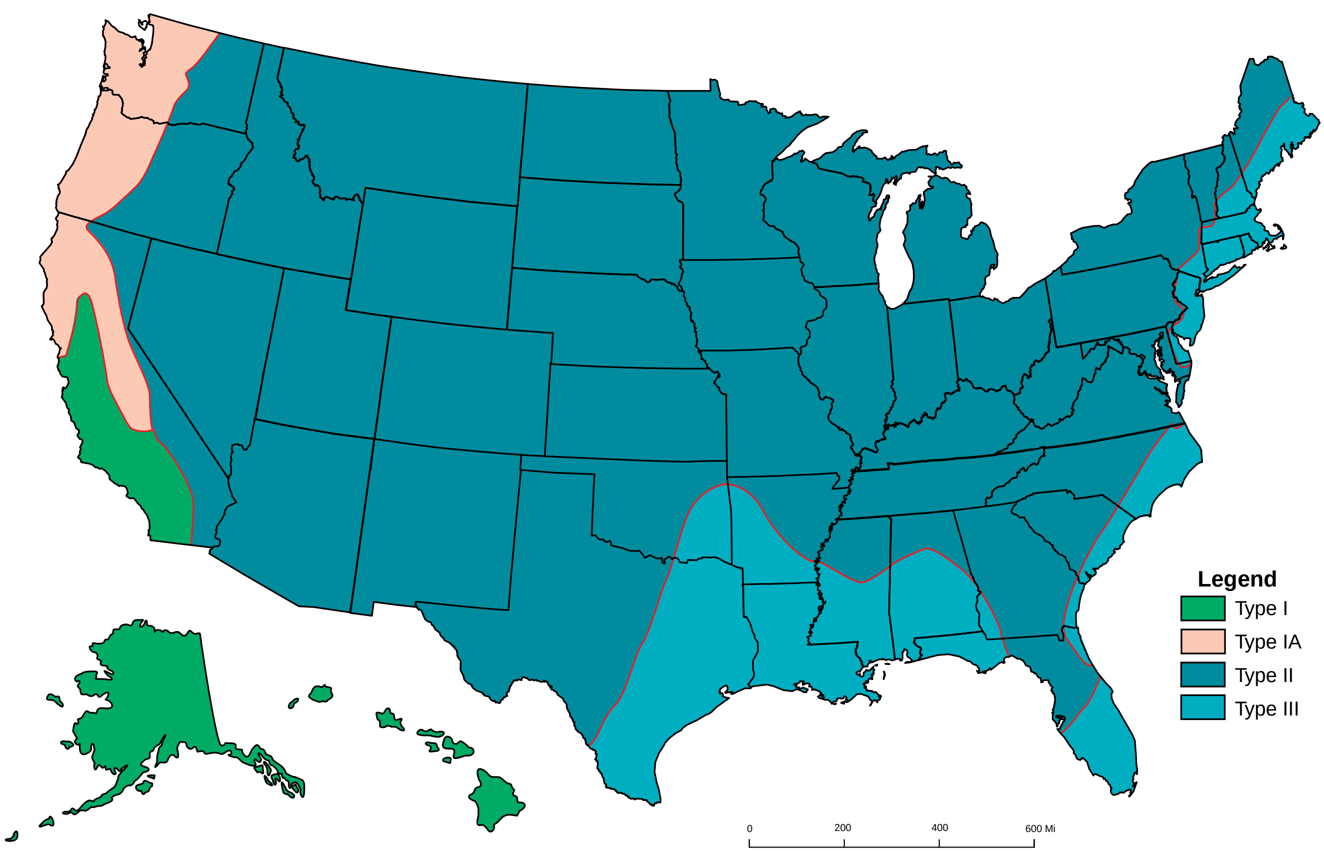
Designing an ordinary pond spillway to accommodate the peak rate of runoff from the most intense rainstorm ever known or anticipated is not practical. The spillway for an ordinary farm pond generally is designed to pass the runoff from a 25-year frequency storm. This means a storm with only a 4 percent chance of occurring in any year or the size beyond which larger storms would not occur more often than an average of once in 25 years. Designing for a 50-year storm frequency is recommended for spillways for larger dams. A 10-year storm frequency may be adequate for sizing the spillway in small ponds.

Rainfall distribution

The highest peak discharges from small watersheds are usually caused by intense, brief rainfalls that may occur as part of a longer duration storm. Different rainfall distributions with respect to time have been developed for four geographic areas of the United States. For each of these areas, a set of synthetic rainfall distributions having nested rainfall intensities were developed. These distributions maximize the rainfall intensities by incorporating selected storm duration intensities within those needed for longer durations at the same probability level.

In figure 15, type I and IA represent the Pacific maritime climate with wet winters and dry summers. Type III represents Gulf of Mexico and Atlantic coastal areas where tropical storms bring large rainfall amounts. Type II represents the rest of the country.

Figure 15 Approximate geographic boundaries for NRCS rainfall distributions



Peak discharge rate

The slope of the land above the pond affects the peak discharge rate significantly. The time of concentration along with the runoff curve number, storm rainfall, and rainfall distribution are used to estimate the peak discharge rate. This rate is used to design the auxiliary spillway width and depth of flow.

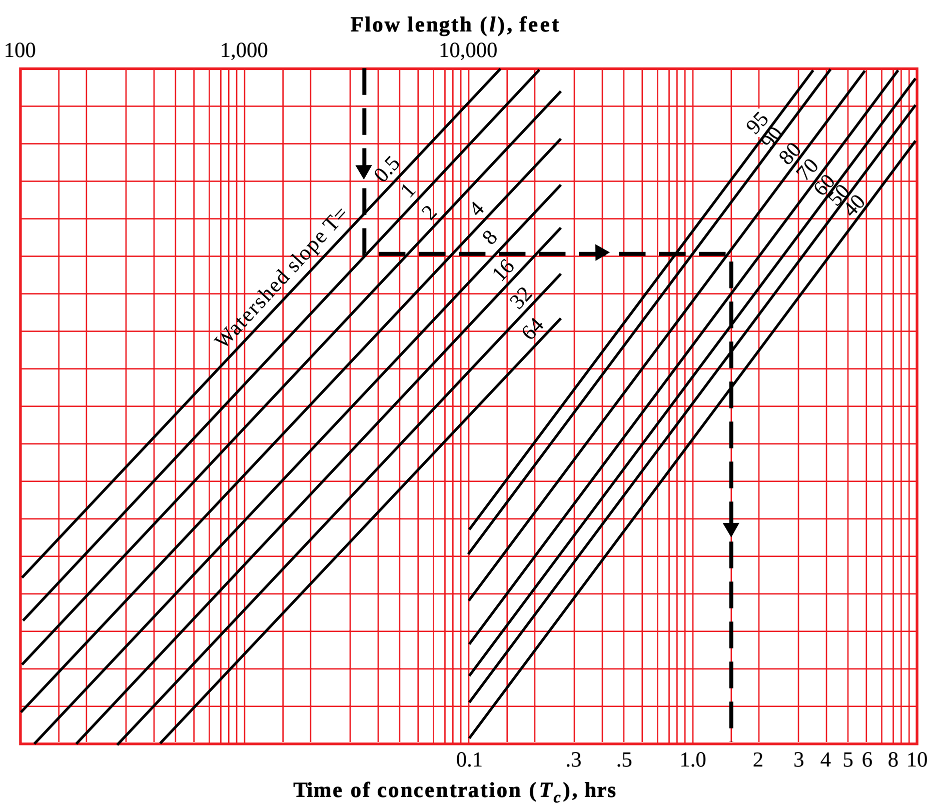
Time of concentration

Time of concentration (T_c) is the time it takes for runoff to travel from the hydraulically most distant point of the watershed to the outlet. T_c influences the peak discharge and is a measure of how fast the water runs off the land. For the same size watershed, the shorter the T_c, the larger the peak discharge. This means that the peak discharge has an inverse relationship with T_c. T_c can be estimated for small rural watersheds using equation 1. Figure 16 is a nomograph for solving this equation.

$$T_c = \frac{l^{0.8}\left[\frac{(1000)}{CN} - 9\right]^{0.7}}{1140\,Y^{0.5}} \qquad \text{[Eq. 1]}$$

where:
T_c = time of concentration, hr
l = flow length, ft
CN = runoff curve number
Y = average watershed slope, %

Figure 16 Time of concentration (T_c) nomograph



Average watershed slope

The average watershed slope (Y) is the slope of the land and not the watercourse. It can be determined from soil survey data or topographic maps. Hillside slopes can be measured with a hand level, lock level, or clinometer in the direction of overland flow. Average watershed slope is an average of individual land slope measurements. The average watershed slope can be determined using equation 2:

$$Y = \frac{100CI}{A} \qquad \text{[Eq. 2]}$$

where:
- Y = average slope, %
- C = total contour length, ft
- I = contour interval, ft
- A = drainage area, ft^2

Flow length

Flow length (l) is the longest flow path in the watershed from the watershed divide to the outlet. It is the total path water travels overland and in small channels on the way to the outlet. The flow length can be determined using a map wheel, or it can be marked along the edge of a paper and converted to feet.

I_a/P ratio

The watershed CN is used to determine the initial abstraction (I_a) from table 6. I_a/P ratio is a parameter that indicates how much of the total rainfall is needed to satisfy the initial abstraction. The larger the I_a/P ratio, the lower the unit peak discharge (q_u) for a given T_c.

Table 6 I_a values for runoff curve numbers

Curve number	I_a (in)	Curve number	I_a (in)
40	3.000	70	0.857
41	2.878	71	0.817
42	2.762	72	0.778
43	2.651	73	0.740
44	2.545	74	0.703
45	2.444	75	0.667
46	2.348	76	0.632
47	2.255	77	0.597
48	2.167	78	0.564
49	2.082	79	0.532
50	2.000	80	0.500
51	1.922	81	0.469
52	1.846	82	0.439
53	1.774	83	0.410
54	1.704	84	0.381
55	1.636	85	0.353
56	1.571	86	0.326
57	1.509	87	0.299
58	1.448	88	0.273
59	1.390	89	0.247
60	1.333	90	0.222
61	1.279	91	0.198
62	1.226	92	0.174
63	1.175	93	0.151
64	1.125	94	0.128
65	1.077	95	0.105
66	1.030	96	0.083
67	0.985	97	0.062
68	0.941	98	0.041
69	0.899		

Estimating peak discharge rates

The unit peak discharge (q_u) is obtained from figure 17 depending on the rainfall type. Figure 15 shows the approximate geographic boundaries for the four rainfall distributions. T_c and I_a/P values are needed to obtain a value for q_u from the exhibit. The peak discharge (q_p in ft^3/s) is computed as the product of the unit peak discharge (q_u in ft^3/s/ac-in), the drainage area (A in acres), and the runoff (Q in inches).

$$q_p = q_u \times A \times Q \qquad \text{[Eq. 3]}$$

Example 1 Estimating peak discharge rates

Known:

Drainage area = 50 acres
Cole County, Missouri
Flow Path 'l' = 1,600 feet
Watershed Slope 'Y' = 4 percent
25-year, 24-hour rainfall = 6 inches
Type II rainfall distribution
Runoff Curve Number = 66
(from example in runoff curve number section)

Solution:

Find T_c
Enter figure 16, T_c = 0.60 hours

Find I_a /P
Enter table 6, use CN = 66, I_a = 1.030
I_a /P = 1.030/6.0 inches = 0.172

Find runoff
Enter table 5, at rainfall = 6.0 inches and runoff curve number = 66,
Read runoff = 2.44 inches. (Note: It was necessary to interpolate between RCN 65 and 70.)

Find the peak discharge for spillway design.

Enter figure 17(c):
q_u = 0.7
$q_p = q_u$ x A x Q
q_p = 0.7 x 50 x 2.44 = 85 ft^3/s

Figure 17a Unit peak discharge (q_u) for Type I storm distribution

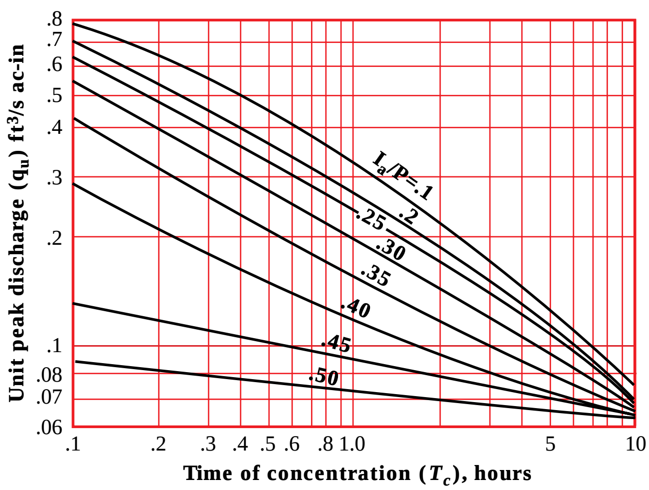


Figure 17c Unit peak discharge (q_u) for Type II storm distribution

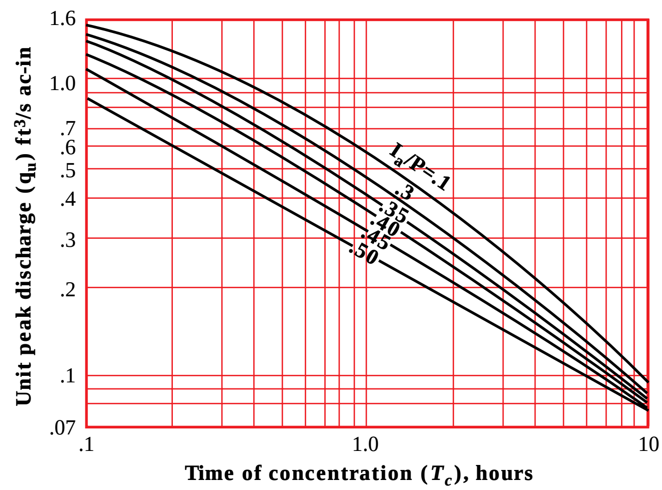


Figure 17b Unit peak discharge (q_u) for Type IA storm distribution

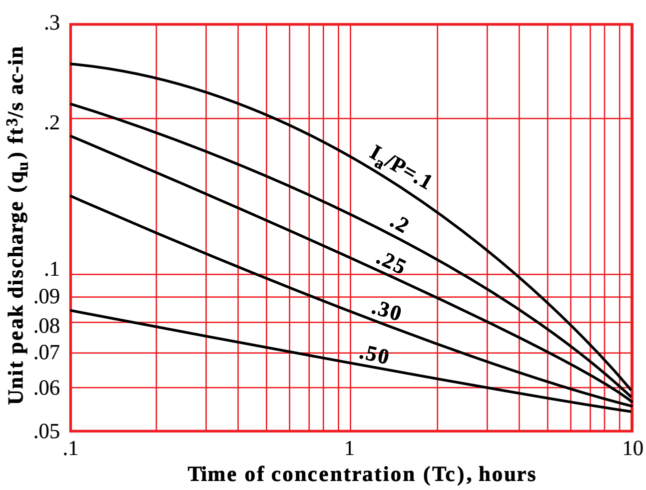
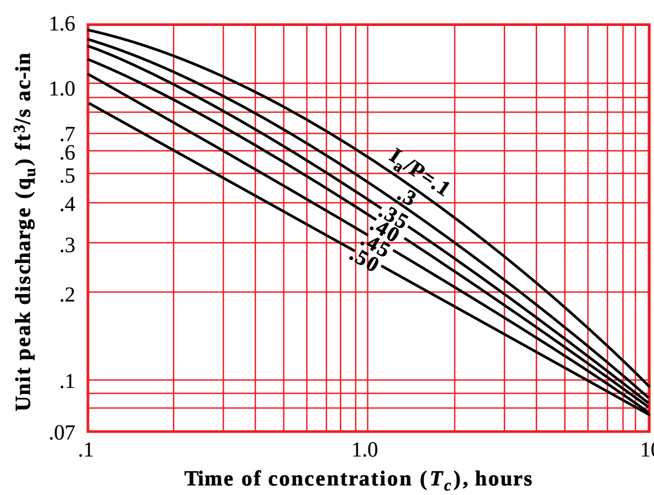


Figure 17d Unit peak discharge (q_u) for Type III storm distribution



Site surveys

Once you determine the probable location of the pond, conduct a site survey to plan and design the dam, spillways, and other features. Those unfamiliar with the use of surveying instruments should employ a licensed surveyor or other qualified professional.

Pond surveys generally consist of a profile of the centerline of the dam, a profile of the centerline of the earth spillway, and enough measurements to estimate pond capacity. A simple method of estimating pond capacity is described on page 12. For larger and more complex ponds, particularly those used for water supply or irrigation, you may need a complete topographic survey of the entire pond site.

Run a line of profile level surveys along the centerline of the proposed dam and up both sides of the valley well above the expected elevation of the top of the dam and well beyond the probable location of the auxiliary spillway. The profile should show the surface elevation at all significant changes in slope and at intervals of no more than 100 feet. This line of levels establishes the height of the dam and the location and elevation of the earth spillway and the principal spillway. It is also used to compute the volume of earthfill needed to build the dam.

Run a similar line of profile levels along the centerline of the auxiliary spillway. Start from a point on the upstream end that is well below the selected normal water surface elevation and continue to a point on the downstream end where water can be safely discharged without damage to the dam. This line serves as a basis for determining the slope and dimensions of the spillway.

All surveys made at a pond site should be tied to a reference called a bench mark. This may be a large spike driven into a tree, an iron rod driven flush with the ground, a point on the concrete headwall of a culvert, or any object that will remain undisturbed during and after construction of the dam.

Embankment ponds

Detailed soils investigation

Soils in the ponded area—Suitability of a pond site depends on the ability of the soils in the reservoir area to hold water. The soil should contain a layer of material that is impervious and thick enough to prevent excessive seepage. Clays and silty clays are excellent for this purpose; sandy and gravelly clays are usually satisfactory. Generally, soils with at least 20 percent passing the No. 200 sieve, a Plasticity Index of more than 10 percent, and an undisturbed thickness of at least 3 feet do not have excessive seepage when the water depth is less than 10 feet. Coarse-textured sands and sand-gravel mixtures are highly pervious and therefore usually unsuitable. The absence of a layer of impervious material over part of the ponded area does not necessarily mean that you must abandon the proposed site. You can treat these parts of the area by one of several methods described later in this handbook. Any of these methods can be expensive.

Some limestone areas are especially hazardous as pond sites. Crevices, sinks, or channels that are not visible from the surface may be in the limestone below the soil mantle. They may empty the pond in a short time. In addition, many soils in these areas are granular. Because the granules do not break down readily in water, the soils remain highly permeable. All the factors that may make a limestone site undesirable are not easily recognized without extensive investigations and laboratory tests. The best clue to the suitability of a site in one of these areas is the degree of success others have had with farm ponds in the immediate vicinity.

Unless you know that the soils are sufficiently impervious and that leakage will not be a problem, you should make soil borings at intervals over the area to be covered with water. Three or four borings per acre may be enough if the soils are uniform. More may be required if there are significant differences.

Foundation conditions—The foundation under a dam must ensure stable support for the structure and provide the necessary resistance to the passage of water.

Soil borings help to investigate thoroughly the foundation conditions under the proposed dam site. The depth of the holes should be at least 1-1/2 times the height of the proposed dam. Ensure there are not any steep dropoffs in the rock surface of the foundation under the dam. Steep dropoffs in the rock surface can result in cracking of the embankment. Study the natural banks (abutments) at the ends of the dam as well as the supporting materials under the dam. If the dam is to be placed on rock, the rock must be examined for thickness and for fissures and seams through which water might pass.

Coarse-textured materials, such as gravel, sand, and gravel-sand mixtures, provide good support for a dam, but are highly pervious and do not hold water. Such materials can be used only if they are sealed to prevent seepage under the dam. You can install a cutoff core trench of impervious material under the dam or blanket the upstream face of the dam and the pond area with a leak-resistant material.

Fine-textured materials, such as silts and clays, are relatively impervious, but have a low degree of stability. They are not good foundation materials, but generally are satisfactory for the size of dams discussed in this handbook. Flattening the side slopes of some dams may be necessary to reduce the unit load on the foundation. Remove peat, muck, and any soil that has a high organic-matter content from the foundation.

Good foundation materials, those that provide both stability and imperviousness, are a mixture of coarse- and fine-textured soils. Some examples are gravel-sand-clay mixtures, gravel-sand-silt mixtures, sand-clay mixtures, and sand-silt mixtures.

Less desirable but still acceptable foundation materials for ordinary pond dams are gravelly clays, sandy clays, silty clays, silty and clayey fine sands, and clayey silts that have slight plasticity.

Fill material—The availability of suitable material for building a dam is a determining factor in selecting a pond site. Enough suitable material should be located close to the site so that placement costs are not excessive. If fill material can be taken from the reservoir area, the surrounding landscape will be left undisturbed and borrow areas will not be visible after the pond has been filled (fig. 18).

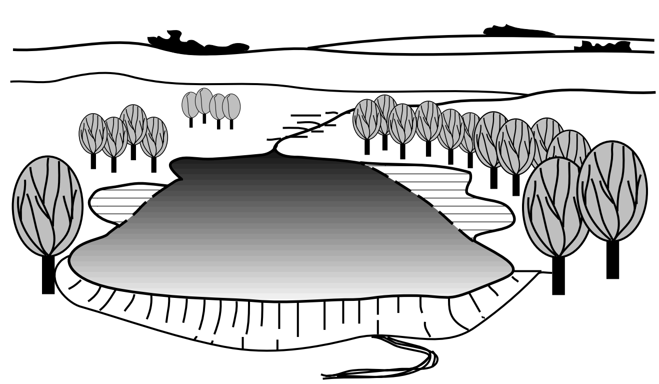
Materials selected must have enough strength for the dam to remain stable and be tight enough, when properly compacted, to prevent excessive or harmful percolation of water through the dam. Soils described as acceptable for foundation material generally are acceptable for fill material. The exceptions are organic silts and clays.

The best material for an earthfill contains particles ranging from small gravel or coarse sand to fine sand and clay in the desired proportions. This material should contain about 20 percent, by weight, clay particles. Though satisfactory earthfills can be built from soils that vary from the ideal, the greater the variance, the more precautions needed.

Soils containing a high percentage of gravel or coarse sand are pervious and can allow rapid seepage through the dam. When using these soils, place a core of clay material in the center of the fill and flatten the side slopes to keep the line of seepage from emerging on the downstream slope.

Fill material that has a high clay content swells when wet and shrinks when dry. The shrinkage may open dangerous cracks. If these soils are dispersive, they represent a serious hazard to the safety of the embankment and should be avoided. Dispersive soils can be identified by how easily they go into suspension in water, by the presence of a gelatinous cloud around a clod of soil in distilled water, and by the indefinite

Figure 18 Borrow material taken from within the reservoir area creates an irregular pond configuration



length of time they stay in suspension in still water. High sodium soils identified in the soil survey for the planned area of the embankment also indicate dispersive soils. If any of these indicators are found at the proposed site, an engineer should be hired to provide the necessary guidance for sampling, testing, and using these soils for fill. For soils consisting mostly of silt, such as the loess areas of western Iowa and along the Mississippi River in Arkansas, Mississippi, and Tennessee, the right degree of moisture must be maintained during construction for thorough compaction.

To estimate the proportion of sand, silt, and clay in a sample of fill material, first obtain a large bottle with straight sides. Take a representative sample of the fill material and remove any gravel by passing the material through a 1/4-inch sieve or screen. Fill the bottle to about one-third with the sample material and finish filling with water. Shake the bottle vigorously for several minutes and then allow the soil material to settle for about 24 hours. The coarse material (sand) settles to the bottom first, and finer material (clay) settles last. Estimate the proportion of sand, silt, and clay by measuring the thickness of the different layers with a ruler.

Landscape planning—The pond should be located and designed to blend with the existing landform, vegetation, water, and structures with minimum disturbance. Landforms can often form the impoundment with minimum excavation. Openings in the vegetation can be used to avoid costly clearing and grubbing. Existing structures, such as stone walls and trails, can be retained to control pedestrian and vehicular traffic and minimize disruption of existing use. In the area where land and water meet, vegetation and landform can provide interesting reflections on the water's surface, guide attention to or from the water, frame the water to emphasize it, and direct passage around the pond.

A pond's apparent size is not always the same as its actual size. For example, the more sky reflected on the water surface, the larger a pond appears. A pond surrounded by trees will appear smaller than a pond the same size without trees or with some shoreline trees (fig. 19). The shape of a pond should complement its surroundings. Irregular shapes with smooth, flowing shorelines generally are more compatible with the patterns and functions found in most landscapes. Peninsulas, inlets, or islands can be constructed to create diversity in the water's edge.

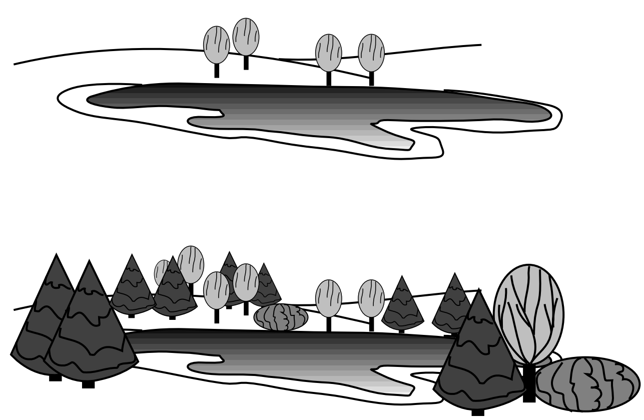
Spillway requirements

A pipe spillway often is used as well as an earth auxiliary spillway to control runoff from the watershed. The principal spillway is designed to reduce the frequency of operation of the auxiliary spillway. Commonly the principal spillway may be a hooded or canopy inlet with a straight pipe or may be a drop inlet (vertical section) that has a pipe barrel through the dam. The pipe shall be capable of withstanding external loading with yielding, buckling, or cracking. The pipe joints and all appurtenances need to be watertight. Pipe materials may be smooth metal, corrugated metal, or plastic. Design limitations exist with all materials.

A small principal spillway pipe, formerly called a trickle tube, only handles a small amount of flow. Its purpose is to aid in keeping the auxiliary spillway dry during the passage of small storm events.

Hooded or canopy inlets are common. A disadvantage of this type inlet is the larger amount of stage (head over the inlet crest) needed to make the pipe flow at full capacity. Conversely, a drop inlet spillway requires less stage because the size of the inlet may be enlarged to make the barrel flow full.

Figure 19 The apparent size of the pond is influenced by surrounding vegetation



The principal spillway normally is sized to control the runoff from a storm ranging from a 1-year to a 10-year frequency event. This depends on the size of the drainage area. For pond sites where the drainage area is small (less than 20 acres) and the condition of the vegetated spillway is good, no principal spillway is required except where the pond is spring fed or there are other sources of steady baseflow. In this case, a trickle tube shall be installed.

Earth spillways have limitations. Use them only where the soils and topography allow the peak flow to discharge safely at a point well downstream and at a velocity that does not cause appreciable erosion either within the spillway or beyond its outlet.

Soil borings generally are required for auxiliary spillways if a natural site with good plant cover is available. If spillway excavation is required, the investigations should be thorough enough to determine whether the soils can withstand reasonable velocities without serious erosion. Avoid loose sands and other highly erodible soils.

No matter how well a dam has been built, it will probably be destroyed during the first severe storm if the capacity of the spillway is inadequate. The function of an auxiliary spillway is to pass excess storm runoff around the dam so that water in the pond does not rise high enough to damage the dam by overtopping. The spillways must also convey the water safely to the outlet channel below without damaging the downstream slope of the dam. The proper functioning of a pond depends on a correctly designed and installed spillway system.

Auxiliary spillways should have the minimum capacity to discharge the peak flow expected from a storm of the frequency and duration shown in table 7 less any reduction creditable to conduit discharge and detention storage. After the spillway capacity requirements are calculated, the permissible velocity must be determined. Table 8 shows the recommended allowable velocity for various cover, degree of erosion resistance, and slope of the channel. Table 9 gives the retardance factors for the expected height of the vegetation.

Both natural and excavated auxiliary spillways are used. A natural spillway does not require excavation to provide enough capacity to conduct the pond outflow to a safe point of release (fig. 20). The requirements discussed later for excavated spillways do not apply to natural spillways, but the capacity must be adequate.

With the required discharge capacity (Q), the end slope of the embankment (Z_1), and the slope of the natural ground (Z_2) known, the maximum depth of water above the level portion (H_p) can be obtained from table 10. The depth is added to the elevation of the spillway crest to determine the maximum elevation to which water will rise in the reservoir.

Table 7 Minimum spillway design storm

Drainage area (acre)	Effective height of dam 1/ (ft)	Storage (acre-ft)	Minimum design storm: Frequency (yr)	Minimum design storm: Minimum duration (hr)
20 or less	20 or less	Less than 50	10	24
20 or less	More than 20	Less than 50	25	24
More than 20	20 or less	Less than 50	25	24
All others			50	24

1/ The effective height of the dam is the difference in elevation between the auxiliary spillway crest and the lowest point in the cross section taken along the centerline of the dam.

Table 8 Permissible velocity for vegetated spillways 1/

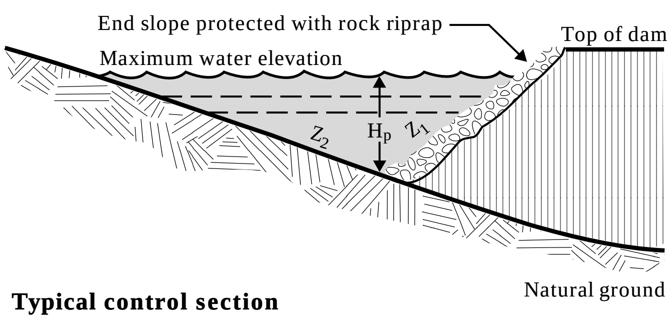
Vegetation	Permissible velocity 2/ — Erosion-resistant soils 3/ — Slope of exit channel (%) 0-5 (ft/s)	Erosion-resistant soils 3/ 5-10 (ft/s)	Easily eroded soils 4/ 0-5 (ft/s)	Easily eroded soils 4/ 5-10 (ft/s)
Bermudagrass	8	7	6	5
Bahiagrass	8	7	6	5
Buffalograss	7	6	5	4
Kentucky bluegrass	7	6	5	4
Smooth brome	7	6	5	4
Tall fescue	7	6	5	4
Reed canarygrass	7	6	5	4
Sod-forming grass-legume mixtures	5	4	4	3
Lespedeza sericea	3.5	3.5	2.5	2.5
Weeping lovegrass	3.5	3.5	2.5	2.5
Yellow bluestem	3.5	3.5	2.5	2.5
Native grass mixtures	3.5	3.5	2.5	2.5

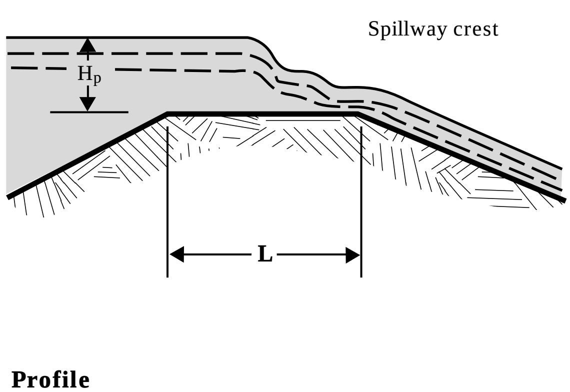
1/ SCS TP-61
2/ Increase values 10 percent when the anticipated average use of the spillway is not more frequent than once in 5 years, or 25 percent when the anticipated average use is not more frequent than once in 10 years.
3/ Those with a higher clay content and higher plasticity. Typical soil textures are silty clay, sandy clay, and clay.
4/ Those with a high content of fine sand or silt and lower plasticity, or nonplastic. Typical soil textures are fine sand, silt, sandy loam, and silty loam.

Table 9 Guide to selection of vegetal retardance

Stand	Average height of vegetation (in)	Degree of retardance
Good	Higher than 30	A
	11 to 24	B
	6 to 10	C
	2 to 6	D
	Less than 2	E
Fair	Higher than 30	B
	11 to 24	C
	6 to 10	D
	2 to 6	D
	Less than 2	E

Figure 20 Plan, profile, and cross section of a natural spillway with vegetation





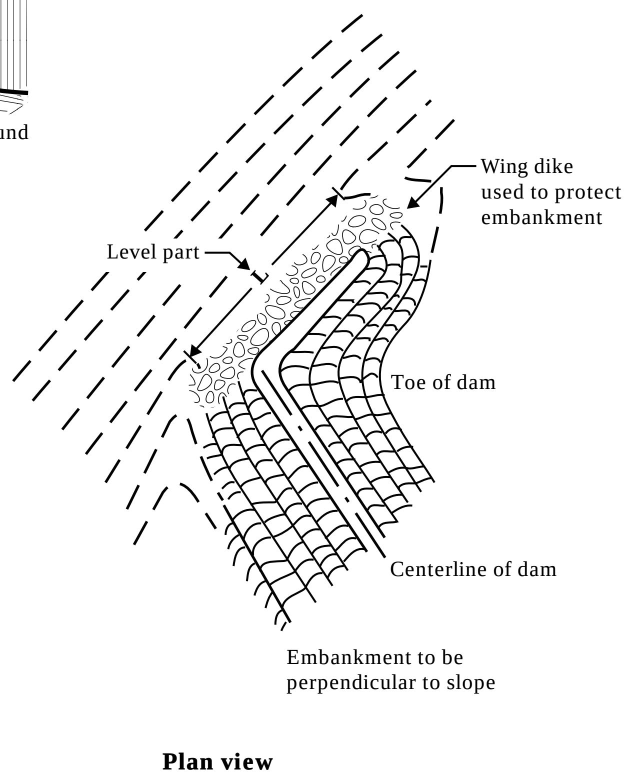


Table 10 H_p discharge and velocities for natural vegetated spillways with 3:1 end slope (Z_1)

Natural ground slope Z_2 (%)	H_p (ft)	A Q (ft³/s)	A V (ft/s)	B Q (ft³/s)	B V (ft/s)	C Q (ft³/s)	C V (ft/s)	D Q (ft³/s)	D V (ft/s)	E Q (ft³/s)	E V (ft/s)	Slope Min. (%)	Slope Max. (%)
0.5	1.0	19	0.3	28	0.5	47	1.3	68	1.8	130	2.8	0.5	3
	1.1	21	.3	35	.5	76	1.5	108	2.1	154	3.0		
	1.2	29	.4	39	.6	97	1.6	122	2.3	204	3.2		
	1.3	36	.4	53	.6	125	2.0	189	2.5	250	3.4		
	1.5	61	.4	87	1.1	210	2.2	291	2.9	393	3.8		
	1.8	81	.5	187	1.8	384	2.9	454	3.5	651	4.5		
	2.0	110	.5	286	2.1	524	3.3	749	3.8	860	4.8		
1	1.0	10	0.4	16	0.5	31	2.0	45	2.6	64	3.4	1	3
	1.1	13	.4	18	.6	50	2.3	63	2.8	90	3.7		
	1.2	15	.5	21	.8	62	2.5	78	3.1	99	4.0		
	1.3	22	.6	39	1.0	86	2.7	144	3.4	139	4.3		
	1.5	40	.7	75	1.8	133	3.1	186	4.0	218	5.1		
	1.8	56	.8	126	2.3	280	3.8	296	4.5				
	2.0	98	1.1	184	2.8	328	4.3	389	5.0				
	2.5	171	2.5	472	4.1	680	5.4						
2	1.0	6	0.5	9	0.8	18	2.5	27	3.3	36	4.2	1	3
	1.1	7	.7	14	1.0	29	2.8	39	3.6	50	4.5		
	1.2	9	.8	19	1.1	40	3.1	51	3.9	64	4.9		
	1.3	13	.9	26	1.6	50	3.4	70	4.3	85	5.3		
	1.5	21	1.0	39	2.0	70	3.9	109	5.1	127	6.3		
	1.8	26	1.1	74	2.5	126	4.8	194	5.9				
	2.0	52	1.3	111	3.2	190	5.4	229	6.4				
	2.5	88	2.8	238	5.2	339	6.8						
3	1.0	4	0.7	7	0.8	15	2.8	21	3.7	28	4.8	1	3
	1.1	5	.8	10	.9	24	3.2	31	4.0	38	5.2		
	1.2	7	.9	14	1.1	33	3.6	41	4.4	49	5.6		
	1.3	10	1.0	20	1.5	42	3.8	57	4.8	67	6.1		
	1.5	16	1.2	34	2.8	62	4.4	89	5.7	104	7.2		
	1.8	23	1.3	57	3.0	112	5.5	143	6.7				
	2.0	39	1.5	81	3.7	163	6.2	194	7.2				
	2.5	85	3.1	212	6.0	300	7.8						
4	1.2	6	1.0	11	1.4	25	3.9	31	4.8	38	6.1	1	4
	1.5	15	1.3	29	3.1	49	4.8	69	5.5	81	7.9		
	1.8	20	1.4	47	4.1	98	6.1	116	7.3				
	2.0	30	1.6	65	4.7	139	6.7	161	7.8				
	2.5	72	3.3	167	6.6	238	8.5						
5	1.5	13	1.4	23	3.3	38	5.2	55	6.7	63	8.4	1	5
	1.8	17	1.5	37	4.4	76	6.5	95	7.9				
	2.0	23	1.7	48	5.1	112	7.1	130	8.1				
	2.5	64	3.7	149	7.1	191	9.2						

The following example shows how to use table 10:

Given:
Vegetation: good stand of bermudagrass
Height: 6 to 10 inches
Slope of natural ground: 1.0 percent

Solution:
From table 9, determine a retardance of C.

From table 10, under natural ground slope 1 percent and retardance C column, find Q = 88 ft^3/s at H_p = 1.3 ft, and V = 2.7 ft/s.

If the freeboard is 1.0 foot, the top of the dam should be constructed 2.3 feet higher than the spillway crest. The velocity is well below the maximum permissible velocity of 6 feet per second given in table 8. H_p can be determined by interpolation when necessary. For a Q greater than that listed in table 10, the spillway should be excavated according to the information in the next section, Excavated auxiliary spillways.

Excavated auxiliary spillways—Excavated spillways consist of the three elements shown in figure 21. The flow enters the spillway through the inlet channel. The maximum depth of flow (H_p) located upstream from the level part is controlled by the inlet channel, level part, and exit channel.

Excavation of the inlet channel or the exit channel, or both, can be omitted where the natural slopes meet the minimum slope requirements. The direction of slope of the exit channel must be such that discharge does not flow against any part of the dam. Wing dikes, sometimes called kicker levees or training levees, can be used to direct the outflow to a safe point of release downstream.

The spillway should be excavated into the earth for its full depth. If this is not practical, the end of the dam and any earthfill constructed to confine the flow should be protected by vegetation or riprap. The entrance to the inlet channel should be widened so it is at least 50 percent greater than the bottom width of the level part. The inlet channel should be reasonably short and should be planned with smooth, easy curves for alignment. It should have a slope toward the reservoir of not less than 2.0 percent to ensure drainage and low water loss at the inlet.

With the required discharge capacity, the degree of retardance, permissible velocity, and the natural slope of the exit channel known, the bottom width of the level and exit sections and the depth of the flow (H_p) can be computed using the figures in table 11. This table shows discharge per foot of width. The natural slope of the exit channel should be altered as little as possible.

The selection of the degree of retardance for a given auxiliary spillway depends mainly on the height and density of the cover chosen (table 9). Generally, the retardance for uncut grass or vegetation is the one to use for capacity determination. Because protection and retardance are lower during establishment and after mowing, to use a lower degree of retardance when designing for stability may be advisable.

The following examples show the use of the information in table 11:

Example 1 where only one retardance is used for capacity and stability:

Given:
Q = 87 ft^3/s (total design capacity)
So = 4 percent (slope of exit channel determined from profile, or to be excavated)
L = 50 ft

Earth spillway is to be excavated in an erosion-resistant soil and planted with a sod-forming grass-legume mixture. After establishment, a good stand averaging from 6 to 10 inches in height is expected.

Required:
Permissible velocity (V)
Width of spillway (b)
Depth of water in the reservoir above the crest (H_p).

Solution:
From table 8 for sod-forming grass-legume mixtures, read permissible velocity V = 5 ft/s.

From table 9 for average height of vegetation of 6 to 10 inches, determine retardance C.

For retardance C, enter table 11 from left at maximum velocity $V = 5$ ft/s. A 4 percent slope is in the slope range of 1–6 with Q of 3 ft³/s/ft.

H_p for L of 50 ft = 1.4 ft.

If the freeboard is 1 foot, the spillway should be constructed 29 feet wide and 2.4 feet deep.

For retardance C, enter table 11 from left at maximum velocity $V = 5$ ft/s. A 4 percent slope is in the slope range of 1–6 with Q of 3 ft³/s/ft.

H_p for L of 50 ft = 1.4 ft.

If the freeboard is 1 foot, the spillway should be constructed 29 feet wide and 2.4 feet deep.

Example 2 where one retardance is used for stability and another is used for capacity:

Given:

So = 4 percent (slope of exit channel determined from profile or to be excavated)
L = 50 ft

Earth spillway is to be excavated in a highly erodible soil and planted with bahiagrass. After establishment a good stand of 11 to 24 inches is expected.

Required:

Permissible velocity (*V*)
Width of spillway (*b*)
Depth of water in reservoir above the crest (*Hp*).

Solution:

From table 8 determine permissible velocity for bahiagrass in a highly erodible soil that has 8 percent slope $V = 5$ ft/s.

From table 9, select retardants to be used for stability during an establishment period that has a good stand of vegetation of 2 to 6 inches (retardance D).

Select retardance to be used for capacity for good stand of vegetation that has a length of 11 to 24 inches (retardance B).

From table 11, enter from left at maximum velocity $V = 5$ ft/s. A slope of 6 percent is in the range for $Q = 2$ ft³/s/ft.

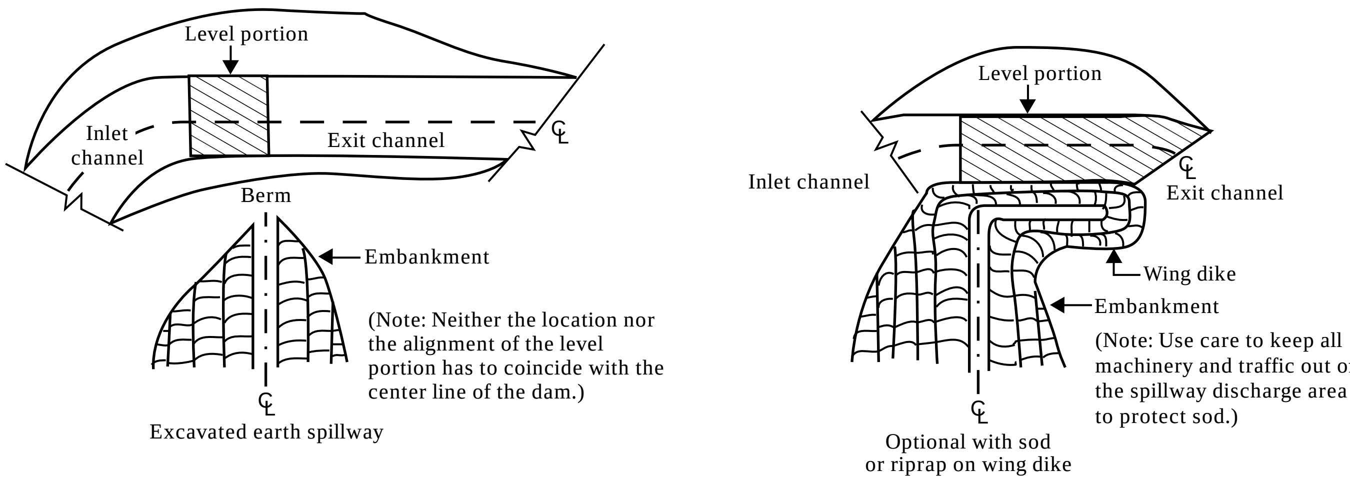
Then

From table 11, enter $q = 2$ ft³/s/ft under retardance B and find H_p for L of 25 ft = 1.4 ft.

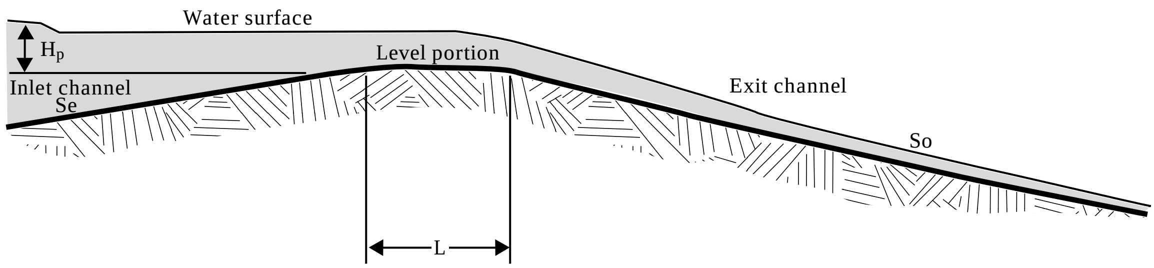
If the freeboard is 1 foot, the spillway should be constructed 50 feet wide and 2.4 feet deep.

Protection against erosion—Protect auxiliary spillways against erosion by establishing good plant cover if the soil and climate permit. As soon after construction as practicable, prepare the auxiliary spillway area for seeding or sodding by applying fertilizer or manure. Sow adapted perennial grasses and protect the seedlings to establish a good stand. Mulching is necessary on the slopes. Irrigation is often needed to ensure good germination and growth, particularly if seeding must be done during dry periods. If the added cost is justified, sprigging or sodding suitable grasses, such as bermudagrass, gives quick protection.

Figure 21 Excavated earth spillway



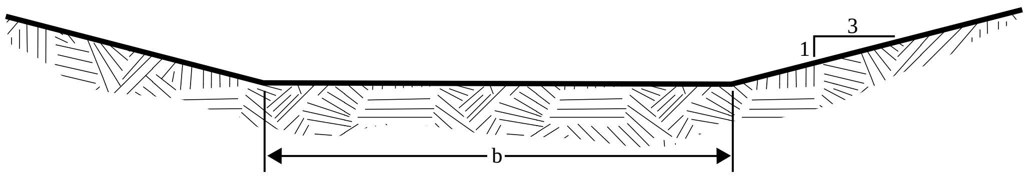
Plan view of earth spillways



Profile along centerline

Definition of terms:

H_p = depth of water in reservoir above crest
L = length of level portion min. 25 ft
b = bottom width of spillway
So = slope for exit channel
Se = slope of inlet channel



Cross section of level portion

Table 11 Depth of flow (H_p) and slope range at retardance values for various discharges, velocities, and crest lengths

	Maximum velocity	Discharge	H_p / L 25	50	100	200	Slope Min.	Slope Max.
	(ft/s)	(ft³/s/ft)	(ft)	(ft)	(ft)	(ft)	(%)	(%)
Retardance A	3	3	2.3	2.5	2.7	3.1	1	11
	4	4	2.3	2.5	2.8	3.1	1	12
	4	5	2.5	2.6	2.9	3.2	1	7
	5	6	2.6	2.7	3.0	3.3	1	9
	6	7	2.7	2.8	3.1	3.5	1	12
	7	10	3.0	3.2	3.4	3.8	1	9
	8	12.5	3.3	3.5	3.7	4.1	1	10
Retardance B	2	1	1.2	1.4	1.5	1.8	1	12
	2	1.25	1.3	1.4	1.6	1.9	1	7
	3	1.5	1.3	1.5	1.7	1.9	1	12
	3	2	1.4	1.5	1.7	1.9	1	8
	4	3	1.6	1.7	1.9	2.2	1	9
	5	4	1.8	1.9	2.1	2.4	1	8
	6	5	1.9	2.1	2.3	2.5	1	10
	7	6	2.1	2.2	2.4	2.7	1	11
	8	7	2.2	2.4	2.6	2.9	1	12
Retardance C	2	0.5	0.7	0.8	0.9	1.1	1	6
	2	1	0.9	1.0	1.2	1.3	1	3
	3	1.25	0.9	1.0	1.2	1.3	1	6
	4	1.5	1.0	1.1	1.2	1.4	1	12
	4	2	1.1	1.2	1.4	1.6	1	7
	5	3	1.3	1.4	1.6	1.8	1	6
	6	4	1.5	1.6	1.8	2.0	1	12
	8	5	1.7	1.8	2.0	2.2	1	12
	9	6	1.8	2.0	2.1	2.4	1	12
	9	7	2.0	2.1	2.3	2.5	1	10
	10	7.5	2.1	2.2	2.4	2.6	1	12
Retardance D	2	0.5	0.6	0.7	0.8	0.9	1	6
	3	1	0.8	0.9	1.0	1.1	1	6
	3	1.25	0.8	0.9	1.0	1.2	1	4
	4	1.25	0.8	0.9	1.0	1.2	1	10
	4	2	1.0	1.1	1.3	1.4	1	4
	5	1.5	0.9	1.0	1.2	1.3	1	12
	5	2	1.0	1.2	1.3	1.4	1	9
	5	3	1.2	1.3	1.5	1.7	1	4
	6	2.5	1.1	1.2	1.4	1.5	1	11
	6	3	1.2	1.3	1.5	1.7	1	7
	7	3	1.2	1.3	1.5	1.7	1	12
	7	4	1.4	1.5	1.7	1.9	1	7
	8	4	1.4	1.5	1.7	1.9	1	12
	8	5	1.6	1.7	1.9	2.0	1	8
	10	6	1.8	1.9	2.0	2.2	1	12

Table 11 Depth of flow (H_p) and slope range at retardance values for various discharges, velocities, and crest lengths—Continued.

	Maximum velocity	Discharge	H_p				Slope	
			L				Min.	Max.
			25	50	100	200		
	(ft/s)	(ft^3/s/ft)	(ft)	(ft)	(ft)	(ft)	(%)	(%)
Retardance E	2	0.5	0.5	0.5	0.6	0.7	1	2
	3	0.5	0.5	0.5	0.6	0.7	1	9
	3	1	0.7	0.7	0.8	0.9	1	3
	4	1	0.7	0.7	0.8	0.9	1	6
	4	1.25	0.7	0.8	0.9	1.0	1	5
	5	1	0.7	0.7	0.8	0.9	1	12
	5	2	0.9	1.0	1.1	1.2	1	4
	6	1.5	0.8	0.9	1.0	1.1	1	12
	6	2	0.9	1.0	1.1	1.2	1	7
	6	3	1.2	1.2	1.3	1.5	1	4
	7	2	0.9	1.0	1.1	1.2	1	12
	7	3	1.2	1.2	1.3	1.5	1	7
	8	3	1.2	1.2	1.3	1.5	1	10
	8	4	1.4	1.4	1.5	1.7	1	6
	10	4	1.4	1.4	1.5	1.7	1	12

Pipes through the dam

Pipe spillways—Protect the vegetation in earth spillway channels against saturation from spring flow or low flows that may continue for several days after a storm. A pipe placed under or through the dam provides this protection. The crest elevation of the entrance should be 12 inches or more below the top of the control section of the auxiliary spillway.

The pipe should be large enough to discharge flow from springs, snowmelt, or seepage. It should also have enough capacity to discharge prolonged surface flow following an intense storm. This rate of flow generally is estimated. If both spring flow and prolonged surface flow can be expected, the pipe should be large enough to discharge both.

Drop inlet and hood inlet pipe spillways are commonly used for ponds.

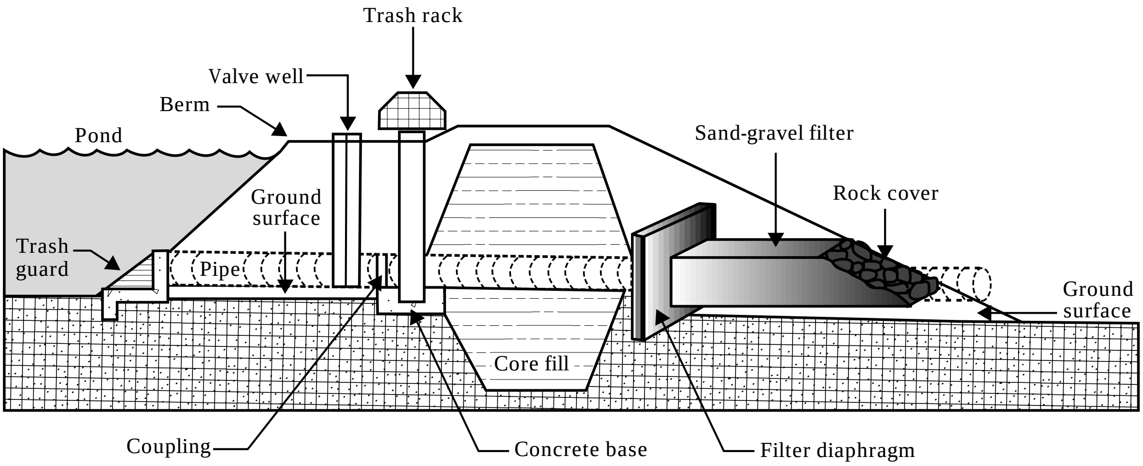
Drop-inlet pipe spillway—A drop-inlet consists of a pipe barrel (fig. 22) located under the dam and a riser connected to the upstream end of the barrel. This riser can also be used to drain the pond if a suitable valve or gate is attached at its upstream end (fig. 23).

With the required discharge capacity determined, use table 12 or 13 to select an adequate pipe size for the barrel and riser. Table 12 is for barrels of **smooth pipe**, and table 13 is for barrels of **corrugated metal** pipe. The diameter of the riser must be somewhat larger than the diameter of the barrel if the tube is to flow full. Recommended combinations of barrel and riser diameters are shown in the tables. In these tables the total head is the vertical distance between a point 1 foot above the riser crest and the centerline of the barrel at its outlet end. Because pipes of small diameter are easily clogged by trash and rodents, no pipe smaller than 6 inches in diameter should be used for the barrel.

Figure 22 Drop-inlet pipe spillway with antiseep collar

Figure 23 Drop-inlet pipe spillways

(a) With sand-gravel filter



(b) With antiseep collar

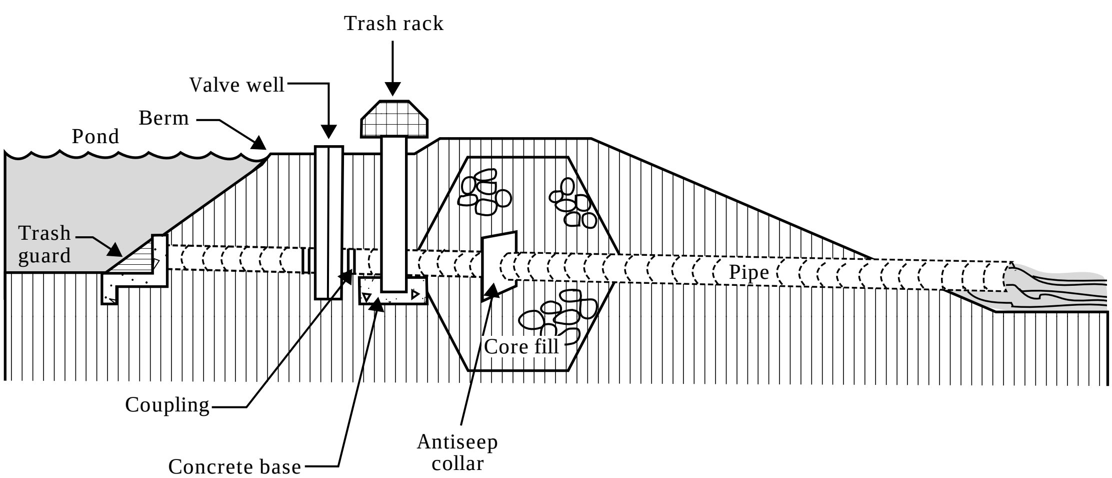


Table 12 Discharge values for **smooth pipe** drop inlets 1/

Total head	Ratio of barrel diameter to riser diameter (in)					
	6:8	8:10	10:12	12:15	15:24	18:36
(ft)	(ft^3/s)	(ft^3/s)	(ft^3/s)	(ft^3/s)	(ft^3/s)	(ft^3/s)
6	1.54	3.1	5.3	8.1	13.6	20.6
8	1.66	3.3	5.7	8.9	14.8	22.5
10	1.76	3.5	6.1	9.6	15.8	24.3
12	1.86	3.7	6.5	10.2	16.8	26.1
14	1.94	3.9	6.8	10.7	17.8	27.8
16	2.00	4.0	7.0	11.1	18.6	29.2
18	2.06	4.1	7.2	11.5	19.3	30.4
20	2.10	4.2	7.4	11.8	19.9	31.3
22	2.14	4.3	7.6	12.1	20.5	32.2
24	2.18	4.4	7.8	12.4	21.0	33.0
26	2.21	4.5	8.0	12.6	21.5	33.8

1/ Length of pipe barrel used in calculations is based on a dam with a 12-foot top width and 2.5:1 side slopes. Discharge values are based on a minimum head on the riser crest of 12 inches. Pipe flow based on Manning's n = 0.012.

Table 13 Discharge values for **corrugated metal pipe** drop inlets 1/

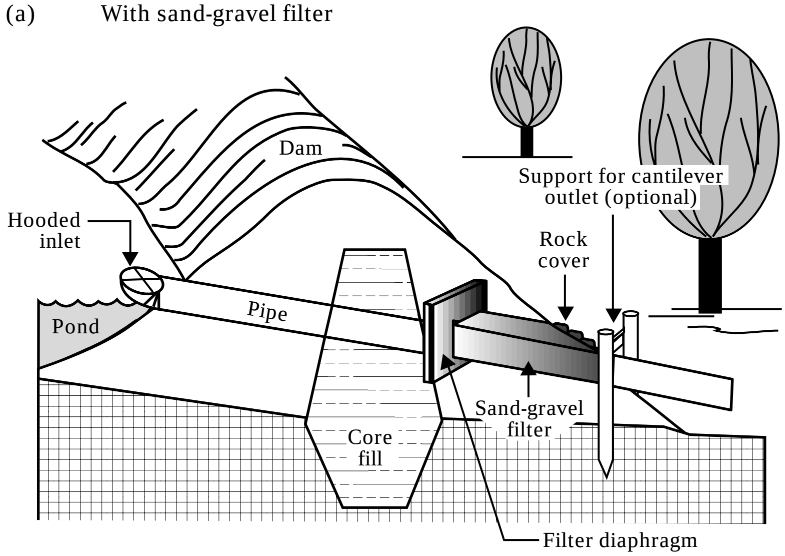
Total head	Ratio of barrel diameter to riser diameter (in)					
	6:8	8:10	10:12	12:15	15:21	18:24
(ft)	(ft^3/s)	(ft^3/s)	(ft^3/s)	(ft^3/s)	(ft^3/s)	(ft^3/s)
6	0.85	1.73	3.1	5.1	8.8	14.1
8	0.90	1.85	3.3	5.4	9.4	15.0
10	0.94	1.96	3.5	5.7	9.9	15.9
12	0.98	2.07	3.7	6.0	10.4	16.7
14	1.02	2.15	3.8	6.2	10.8	17.5
16	1.05	2.21	3.9	6.4	11.1	18.1
18	1.07	2.26	4.0	6.6	11.4	18.6
20	1.09	2.30	4.1	6.7	11.7	18.9
22	1.11	2.34	4.2	6.8	11.9	19.3
24	1.12	2.37	4.2	6.9	12.1	19.6
26	1.13	2.40	4.3	7.0	12.3	19.9

1/ Length of pipe barrel used in calculations is based on a dam with a 12-foot top width and 2.5:1 side slopes. Discharge values are based on a minimum head on the riser crest of 12 inches. Pipe flow based on Manning's n = 0.012.

Hood-inlet pipe spillway—A hood-inlet consists of a pipe laid in the earthfill (fig. 24). The inlet end of the pipe is cut at an angle to form a hood. An antivortex device, usually metal, is attached to the entrance of the pipe to increase the hydraulic efficiency of the tube. Typical installations of hood inlets and details of the antivortex device are shown in figure 25. Often a hood-inlet can be built at less cost than a drop-inlet because no riser is needed. The major disadvantage of this kind of pipe spillway is that it cannot be used as a drain.

Figure 24 Dam with hooded inlet pipe spillway

(a) With sand-gravel filter



(b) With antiseep collar

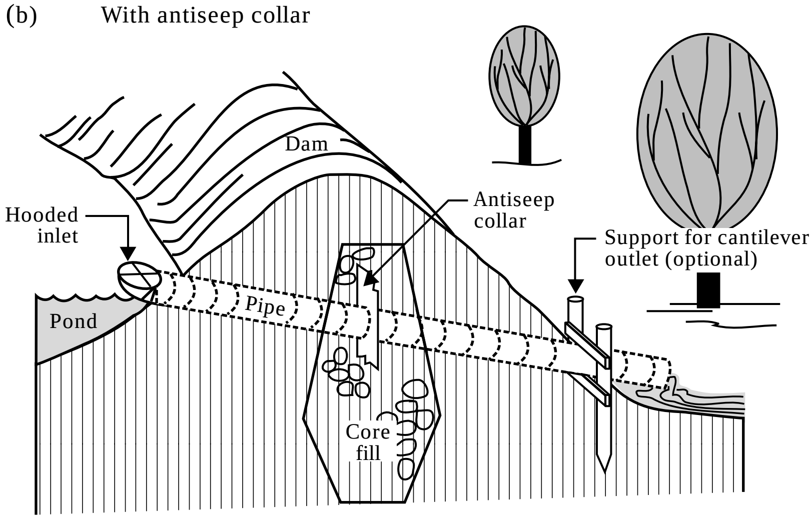
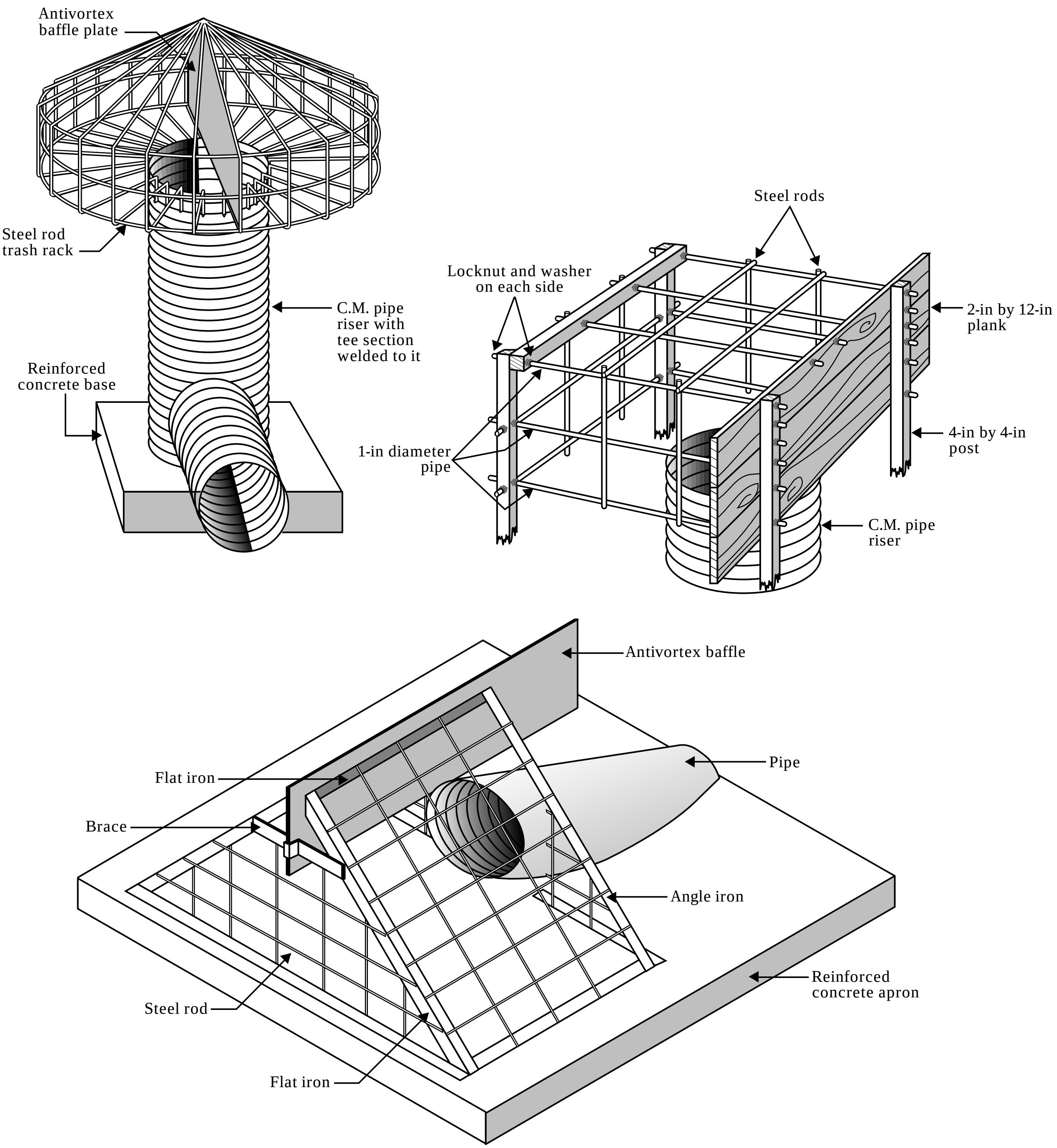


Figure 25 Pipe inlet spillways that have trash rack and antivortex baffle



The required diameter for a hood-inlet pipe can be selected from table 14 or 15 after estimating the discharge capacity, *Q*, and determining the total head, *H*. The tables also show the minimum head, *h*, required above the invert or crest elevation of the pipe entrance. Unless you provide this minimum head, the pipe will not flow full.

Pipe made of cast iron, smooth steel, concrete, plastic, or corrugated metal is suitable for either kind of pipe spillway. All joints must be watertight. A concrete cradle or bedding is needed for concrete pipe to ensure a firm foundation and good alignment of the conduit. Seal the joints of concrete pipe with an approved type of rubber gasket to give them the desired amount of flexibility. For all pipe spillways, use new pipe or pipe so slightly used that it may be considered equivalent to new pipe.

To retard seepage through the embankment along the outside surface of the pipe, compact the fill around the pipe and use a filter and drainage diaphragm around the pipe like that shown in figure 24.

One filter and drainage diaphragm should be used around any structure that extends through the embankment to the downstream slope. The diaphragm should be located downstream of the centerline of a homogeneous embankment or downstream of the cutoff trench. The diaphragm should be a minimum of 3 feet thick and extend around the pipe surface a minimum of 2 times the outside diameter of the pipe ($2D_o$). When a cradle or bedding is used under the pipe, the vertical downward $2D_o$ is measured from the bottom of the cradle or bedding. If bedrock is encountered within the $2D_o$ measurement, the diaphragm should terminate at the bedrock surface. The location

Table 14 Minimum head, *h* (ft), required above the invert of hood inlets to provide full flow, *Q* (ft^3/s), for various sizes of **smooth pipe** and values of total head, *H* 1/

Total head	Diameter of pipe in inches					
(ft)	6	8	10	12	15	18
6	h = 0.63	h = 0.85	h = 1.04	h = 1.23	h = 1.54	h = 1.82
	Q = 1.63	Q = 3.0	Q = 5.3	Q = 8.5	Q = 14.0	Q = 21.2
8	h = 0.65	h = 0.86	h = 1.06	h = 1.27	h = 1.57	h = 1.87
	Q = 1.78	Q = 3.5	Q = 6.0	Q = 9.3	Q = 15.5	Q = 23.3
10	h = 0.66	h = 0.87	h = 1.08	h = 1.30	h = 1.60	h = 1.91
	Q = 1.93	Q = 3.8	Q = 6.6	Q = 10.2	Q = 17.0	Q = 25.4
12	h = 0.67	h = 0.88	h = 1.09	h = 1.32	h = 1.63	h = 1.94
	Q = 2.06	Q = 4.1	Q = 7.1	Q = 10.9	Q = 18.3	Q = 27.5
14	h = 0.67	h = 0.89	h = 1.11	h = 1.33	h = 1.65	h = 1.96
	Q = 2.18	Q = 4.3	Q = 7.5	Q = 11.6	Q = 19.5	Q = 29.4
16	h = 0.68	h = 0.90	h = 1.13	h = 1.35	h = 1.67	h = 1.98
	Q = 2.28	Q = 4.5	Q = 7.8	Q = 12.2	Q = 20.5	Q = 31.0
18	h = 0.69	h = 0.91	h = 1.14	h = 1.36	h = 1.69	h = 2.00
	Q = 2.36	Q = 4.7	Q = 8.1	Q = 12.7	Q = 21.4	Q = 32.5
20	h = 0.69	h = 0.92	h = 1.15	h = 1.37	h = 1.70	h = 2.02
	Q = 2.43	Q = 4.9	Q = 8.4	Q = 13.2	Q = 22.2	Q = 33.9
22	h = 0.70	h = 0.93	h = 1.16	h = 1.38	h = 1.71	h = 2.04
	Q = 2.50	Q = 5.0	Q = 8.7	Q = 13.6	Q = 23.0	Q = 35.1
24	h = 0.70	h = 0.93	h = 1.16	h = 1.39	h = 1.72	h = 2.05
	Q = 2.56	Q = 5.1	Q = 9.0	Q = 14.0	Q = 23.7	Q = 36.3
26	h = 0.71	h = 0.94	h = 1.17	h = 1.40	h = 1.73	h = 2.07
	Q = 2.60	Q = 5.2	Q = 9.3	Q = 14.4	Q = 24.4	Q = 37.5

1/ Length of pipe used in calculations is based on a dam with a 12-foot top width and 2.5:1 side slopes. Pipe flow based on Manning's *n* = 0.012.

of the diaphragm should never result in a minimum soil cover over a portion of the diaphragm measured normal to the nearest embankment surface of less than 2 feet. If this requirement is exceeded, the filter and drainage diaphragm should be moved upstream until the 2-foot minimum is reached. The outlet for the filter and drainage diaphragm should extend around the pipe surface a minimum of 1.5 times the outside diameter of the pipe (1.5*Do*) that has 1 foot around the pipe being a minimum.

In most cases where the embankment core consists of fine-grained materials, such as sandy or gravelly silts and sandy or gravelly clay (15 to 85 percent passing the No. 200 sieve), an aggregate conforming to ASTM C-33 fine concrete aggregate is suitable for the filter and drainage diaphragm material. A fat clay or elastic silt (more than 85 percent passing No. 200 sieve) core requires special design considerations, and an engineer experienced in filter design should be consulted.

Using a filter and drainage diaphragm has many advantages. Some are as follows:

- They provide positive seepage control along structures that extend through the fill.
- Unlike concrete antiseep collars, they do not require curing time.
- Installation is easy with little opportunity for constructed failure. The construction can consist mostly of excavation and backfilling with the filter material at appropriate locations.

Antiseep collars can be used instead of the filter and drainage diaphragm. Antiseep collars have been used

Table 15 Minimum head, *h* (ft), required above the invert of hood inlets to provide full flow, *Q* (ft^3/s), for various sizes of **corrugated pipe** and values of total head, *H* 1/

Total head	Diameter of pipe in inches					
(ft)	6	8	10	12	15	18
6	h = 0.59	h = 0.78	h = 0.97	h = 1.17	h = 1.46	h = 1.75
	Q = 0.92	Q = 1.9	Q = 3.3	Q = 5.3	Q = 9.1	Q = 14.5
8	h = 0.59	h = 0.79	h = 0.98	h = 1.18	h = 1.48	h = 1.77
	Q = 1.00	Q = 2.1	Q = 3.6	Q = 5.8	Q = 10.0	Q = 16.0
10	h = 0.60	h = 0.79	h = 0.99	h = 1.19	h = 1.49	h = 1.79
	Q = 1.06	Q = 2.2	Q = 3.9	Q = 6.3	Q = 10.9	Q = 17.3
12	h = 0.60	h = 0.80	h = 1.00	h = 1.20	h = 1.50	h = 1.80
	Q = 1.12	Q = 2.3	Q = 4.2	Q = 6.7	Q = 11.6	Q = 18.5
14	h = 0.61	h = 0.81	h = 1.01	h = 1.21	h = 1.51	h = 1.82
	Q = 1.18	Q = 2.4	Q = 4.4	Q = 7.1	Q = 12.2	Q = 19.6
16	h = 0.61	h = 0.81	h = 1.01	h = 1.21	h = 1.52	h = 1.82
	Q = 1.22	Q = 2.5	Q = 4.6	Q = 7.4	Q = 12.7	Q = 20.5
18	h = 0.61	h = 0.81	h = 1.02	h = 1.22	h = 1.53	h = 1.83
	Q = 1.26	Q = 2.6	Q = 4.8	Q = 7.6	Q = 13.2	Q = 21.3
20	h = 0.62	h = 0.82	h = 1.03	h = 1.23	h = 1.54	h = 1.85
	Q = 1.30	Q = 2.7	Q = 4.9	Q = 7.8	Q = 13.7	Q = 21.9
22	h = 0.62	h = 0.83	h = 1.03	h = 1.24	h = 1.55	h = 1.86
	Q = 1.33	Q = 2.8	Q = 5.0	Q = 8.0	Q = 14.1	Q = 22.5
24	h = 0.63	h = 0.83	h = 1.04	h = 1.25	h = 1.56	h = 1.88
	Q = 1.35	Q = 2.8	Q = 5.1	Q = 8.2	Q = 14.5	Q = 23.0
26	h = 0.63	h = 0.84	h = 1.05	h = 1.26	h = 1.58	h = 1.89
	Q = 1.37	Q = 2.9	Q = 5.2	Q = 8.3	Q = 14.7	Q = 23.4

1/ Length of pipe used in calculations is based on a dam with a 12-foot top width and 2.5:1 side slopes. Pipe flow based on Manning's *n* = 0.025.

with pipe spillways for many years. More fabricated materials are required for this type of installation. Both types of seepage control are acceptable; in either case, proper installation is imperative.

If an antiseep collar is used, it should extend into the fill a minimum of 24 inches perpendicular to the pipe. If the dam is less than 15 feet high, one antiseep collar at the centerline of the fill is enough. For higher dams, use two or more collars equally spaced between the fill centerline and the upstream end of the conduit when a hood-inlet pipe is used. If a drop-inlet pipe is used, the antiseep collars should be equally spaced between the riser and centerline of the fill.

Use trash racks to keep pipes from clogging with trash and debris. Of the many kinds of racks that have been used, the three shown in figure 25 have proved the most successful.

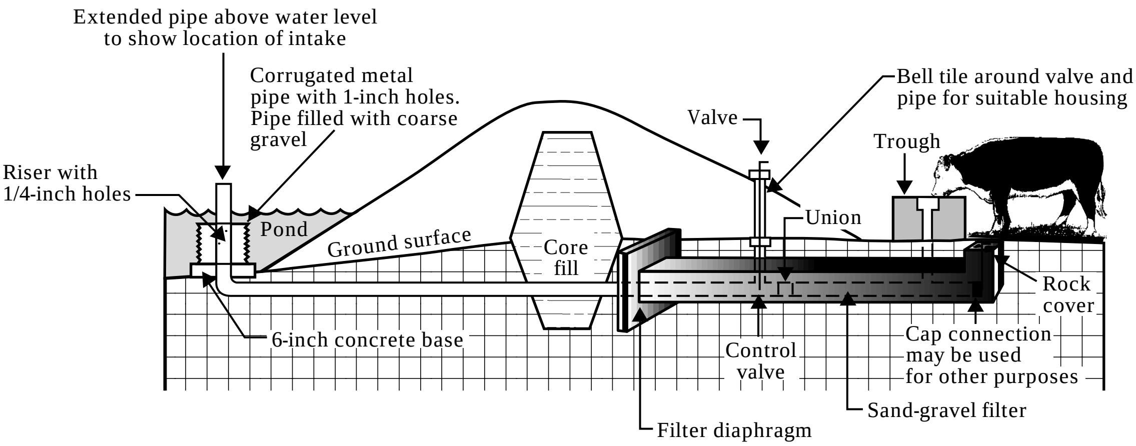
Extend the pipe 6 to 10 feet beyond the downstream toe of the dam to prevent damage by the flow of water from the pipe. For larger pipes, support the extension with a timber brace.

Drainpipes—Some state regulatory agencies require that provision be made for draining ponds completely or for fluctuating the water level to eliminate breeding places for mosquitoes. Whether compulsory or not, provision for draining a pond is desirable and recommended. It permits good pond management for fish production and allows maintenance and repair without cutting the fill or using siphons, pumps, or other devices to remove the water. Install a suitable gate or other control device and extend the drainpipe to the upstream toe of the dam to drain the pond.

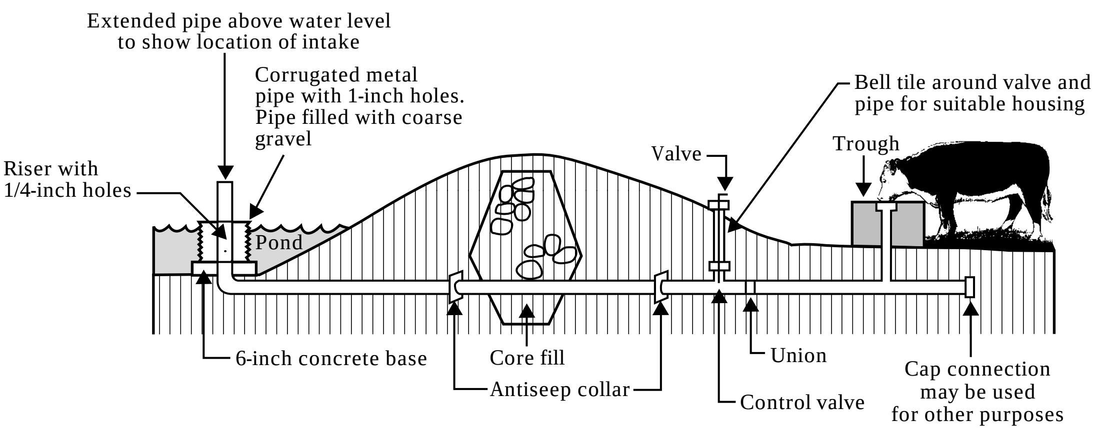
Water-supply pipes—Provide a water-supply pipe that runs through the dam if water is to be used at some point below the dam for supplying a stockwater trough, for irrigation, or for filling an orchard spray tank (fig. 26). This pipe is in addition to the principal spillway. A water-supply pipe should be rigid and have watertight joints, a strainer at its upper end, and a valve at its outlet end. For a small rate of flow, such as that needed to fill stockwater troughs, use steel or plastic pipe that is l-l/2 inches in diameter. For a larger rate of flow, such as that needed for irrigation, use steel, plastic, or concrete pipe of larger diameter. Water-supply pipes also should have watertight joints and antiseep collars or a filter and drainage diaphragm.

Figure 26 Water is piped through the dam's drainpipe to a stockwater trough

(a) Pipe with sand-gravel filter



(b) Pipe with antiseep collars



Planning an earthfill dam

Foundations—You can build a safe earthfill dam on almost any foundation if you thoroughly investigate the foundation and adapt the design and construction to the conditions. Some foundation conditions require expensive construction measures that cannot be justified for small ponds.

The most satisfactory foundation consists of soil underlain at a shallow depth by a thick layer of relatively impervious consolidated clay or sandy clay. If a suitable layer is at or near the surface, no special measures are needed except removing the topsoil and scarifying or disking to provide a bond with the material in the dam.

If the foundation is sand or a sand-gravel mixture and there is no impervious clay layer at a depth that can be reached economically with available excavating equipment, an engineer should design the dam. Although such foundations may be stable, corrective measures are needed to prevent excessive seepage and possible failure. A foundation, consisting of or underlain by a highly plastic clay or unconsolidated material requires careful investigation and design to obtain stability. If the foundation consists of such materials, consult an engineer.

Water impounded on a bedrock foundation seldom gives cause for concern unless the rock contains seams, fissures, or crevices through which water may escape at an excessive rate. Where rock is in the foundation, investigate the nature of the rock carefully.

Cutoffs—If the dam's foundation is overlain by alluvial deposits of pervious sands and gravels at or near the surface and rock or clay at a greater depth, seepage in the pervious stratum must be reduced to prevent possible failure of the dam by piping. To prevent excessive seepage, you need a cutoff to join the impervious stratum in the foundation with the base of the dam.

The most common kind of cutoff is made of compacted clayey material. A trench is excavated along the centerline of the dam deep enough to extend well into the impervious layer (fig. 27). This trench extends into and up the abutments of the dam as far as there is any pervious material that might allow seepage. The bottom of the trench should be no less than 8 feet wide (or the bulldozer blade width, whichever is greater), and the sides no steeper than 1.5:1. Fill the trench with successive thin layers (9-inch maximum) of clay or sandy clay material. Compact each layer thoroughly at near-optimum moisture conditions before placing the next layer. The moisture content is adequate for compaction when the material can be formed into a firm ball that sticks together and remains intact when the hand is vibrated violently and no free water appears.

Top width and alignment—For dams less than 10 feet high, a conservative minimum top width is 6 feet. As the height of the dam increases, increase the top width. The recommended minimum top width for earth embankments of various heights is:

Height of dam (ft)	Minimum top width (ft)
Under 10	6
11 to 14	8
15 to 19	10
20 to 24	12
25 to 34	14

If the top of the embankment is to be used for a roadway, provide for a shoulder on each side of the roadway to prevent raveling. The top width should be at least 16 feet. In some situations a curved dam align-

Figure 27 A core trench is cut on the centerline of a dam

ment is more desirable than a straight alignment. Curvature can be used to retain existing landscape elements, reduce the apparent size of the dam, blend the dam into surrounding natural landforms, and provide a natural-appearing shoreline.

Side slopes—The side slopes of a dam depend primarily on the stability of the fill and on the strength and stability of the foundation material. The more stable the fill material, the steeper the side slopes. Unstable materials require flatter side slopes. Recommended slopes for the upstream and downstream faces of dams built of various materials are shown in table 16.

For stability, the slopes should not be steeper than those shown in table 16, but they can be flatter as long as they provide surface drainage. The side slopes need not be uniform, but can be shaped to blend with the surrounding landforms (fig. 28).

Finish-grading techniques used to achieve a smooth landform transition include slope rounding and slope warping. Slope rounding is used at the top and bottom of cuts or fills and on side slope intersections. Slope warping is used to create variety in the horizontal and vertical pitch of finished slopes (fig. 29). Additional fill can be placed on the backslope and abutments of the dam, if needed, to achieve this landform transition.

Freeboard—Freeboard is the additional height of the dam provided as a safety factor to prevent overtopping by wave action or other causes. It is the vertical distance between the elevation of the water surface in the pond when the spillway is discharging at designed depth and the elevation of the top of the dam after all settlement. If your pond is less than 660 feet long, provide a freeboard of no less than l foot. The minimum freeboard is 1.5 feet for ponds between 660 and 1,320 feet long, and is 2 feet for ponds up to a half mile long. For longer ponds an engineer should determine the freeboard.

Settlement allowance—Settlement or consolidation depends on the character of the materials in both the dam and the foundation and on the construction method. To allow for settlement, build earth dams somewhat higher than the design dimensions. If your dam is adequately compacted in thin layers under good moisture conditions, there is no reason to expect any appreciable settlement in the dam itself, but the foundation may settle. For a compacted fill dam on unyielding foundation, settlement is negligible.

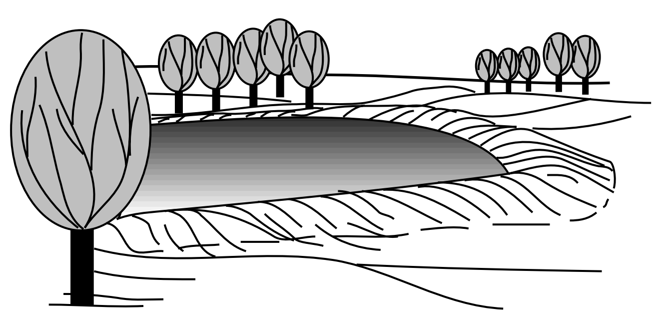
Most foundations are yielding, and settlement may range from l to 6 percent of the height of the dam, mainly during construction. The settlement allowance for a rolled-fill dam should be about 5 percent of the designed dam height. In other words, the dam is built 5 percent higher than the designed height. After settlement, the height of the dam will be adequate. Most pond dams less than 20 feet high, however, are not rolled fill. For these dams the total settlement allowance should be about 10 percent.

Estimating the volume of the earthfill—After planning is completed, estimate the number of cubic yards of earthfill required to build the dam. Also estimate excavation yardage in foundation stripping, core trench excavation, and any other significant excavations. This helps predict the cost of the dam

Table 16 Recommended side slopes for earth dams

Fill material	Slope Upstream	Slope Downstream
Clayey sand, clayey gravel, sandy clay, silty sand, silty gravel	3:1	2:1
Silty clay, clayey silt	3:1	3:1

Figure 28 Dam side slopes are curved and shaped to blend with surrounding topography



and serves as a basis for inviting bids and for awarding a construction contract. The estimate of the volume of earthfill should include

- volume in the dam itself including the allowance for settlement,
- volume required to backfill the cutoff trench,
- volume required to backfill stream channels or holes in the foundation area, and
- any other volume of earthfill the contractor is required to move.

Volume estimates for dams generally are made of the required number of cubic yards of earthfill in place. Probably the most efficient method of estimating the volume of earthfill is the sum-of-end-area method. The ground surface elevations at all points along the centerline of the dam where the slope changes significantly are established by the centerline profile. With the settled top elevation of the dam established, you can obtain the settle fill height at each of these points by subtracting the ground surface elevation from the settle top elevation. With the fill heights, side slopes, and top width established, find the end areas at each of these stations along the centerline in table 17.

For example, assume that a dam has slopes of 3:1 on both upstream and downstream sides and a top width of 12 feet. For a point along the centerline where the fill is 15 feet high, the table shows that the end area at that point is 675 plus 180, or 855 square feet. The number of cubic yards of fill between two points on the centerline of the dam is equal to the sum of the end areas at those two points multiplied by the distance between these points and divided by 54. The total volume of earthfill in the dam is the sum of all such segments. A sample volume estimate illustrating the use of the sum-of-end-areas method is shown in table 18.

Figure 29 Finished grading techniques

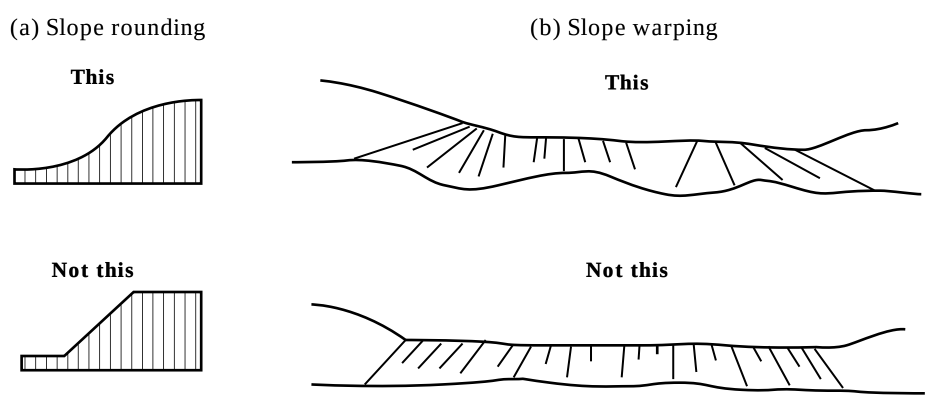


Table 17 End areas in square feet of embankment sections for different side slopes and top widths [1/]

Fill height (ft)	Side slopes 2.5:1 2.5:1 ― 2:1 3:1	 2.5:1 3:1 ― 2:1 3.5:1	 3:1 3:1 ― 2.5:1 3.5:1	 3.5:1 3.5:1 ― 3:1 4:1	 4:1 4:1 ― 3:1 5:1	Top width (ft) 8	 10	 12	 14	 16
1.0	3	3	3	4	4	8	10	12	14	16
1.2	4	4	4	5	6	10	12	14	17	19
1.4	5	5	6	7	8	11	14	17	20	22
1.6	6	7	8	9	10	13	16	19	22	26
1.8	8	9	10	11	13	14	18	22	25	29
2.0	10	11	12	14	16	16	20	24	28	32
2.2	12	13	15	17	19	18	22	27	31	35
2.4	14	16	17	20	23	19	24	29	34	39
2.6	17	19	20	24	27	21	26	31	36	42
2.8	20	22	23	27	31	22	28	34	39	45
3.0	22	25	27	32	36	24	30	36	42	48
3.2	26	28	31	36	41	26	32	38	45	51
3.4	29	32	35	40	46	27	34	41	47	55
3.6	32	36	39	45	52	29	36	43	50	58
3.8	36	40	43	50	58	30	38	46	53	61
4.0	40	44	48	56	64	32	40	48	56	64
4.2	44	49	53	62	71	34	42	50	59	67
4.4	48	53	58	68	77	35	44	53	61	71
4.6	53	58	63	74	85	37	46	55	64	74
4.8	57	63	69	81	92	38	48	57	67	77
5.0	62	69	75	87	100	40	50	60	70	80
5.2	67	74	81	94	108	42	52	62	73	83
5.4	73	80	87	102	117	43	54	65	75	87
5.6	78	86	94	110	125	45	56	67	78	90
5.8	84	93	101	118	135	46	58	69	81	93
6.0	90	99	108	126	144	48	60	72	84	96
6.2	96	106	115	135	154	50	62	74	87	99
6.4	102	113	123	143	164	51	64	77	89	103
6.6	109	120	131	152	174	53	66	79	92	106
6.8	116	128	139	162	185	54	68	81	95	109
7.0	123	135	147	172	196	56	70	84	98	112
7.2	130	143	156	182	207	58	72	86	101	115
7.4	138	152	165	193	219	59	74	89	103	119
7.6	145	159	174	203	231	61	76	91	106	122
7.8	153	168	183	214	243	62	78	93	109	125
8.0	160	176	192	224	256	64	80	96	112	128
8.2	169	185	202	235	269	66	82	98	115	131
8.4	177	194	212	247	282	67	84	101	117	135
8.6	186	204	222	259	296	69	86	103	120	138
8.8	194	213	232	271	310	70	88	105	123	141

See footnote at end of table.

Table 17 End areas in square feet of embankment sections for different side slopes and top widths 1/—Continued.

Fill height (ft)	Side slopes					Top width (ft)				
	2.5:1 2.5:1 / 2:1 3:1	2.5:1 3:1 / 2:1 3.5:1	3:1 3:1 / 2.5:1 3.5:1	3.5:1 3.5:1 / 3:1 4:1	4:1 4:1 / 3:1 5:1	8	10	12	14	16
9.0	203	223	243	283	324	72	90	108	126	144
9.2	212	233	254	296	339	74	92	110	129	147
9.4	222	244	266	310	353	75	94	113	131	151
9.6	231	254	277	323	369	77	96	115	134	154
9.8	241	265	289	337	384	78	98	117	137	157
10.0	250	275	300	350	400	80	100	120	140	160
10.2	260	286	313	364	416		102	122	143	163
10.4	271	298	325	379	433		104	125	145	167
10.6	281	309	338	394	449		106	127	148	170
10.8	292	321	350	409	467		108	129	151	173
11.0	302	333	363	424	484		110	132	154	176
11.2	313	344	376	440	502		112	134	157	179
11.4	325	357	390	456	520		114	137	159	183
11.6	336	370	404	472	538		116	139	162	186
11.8	348	383	418	488	557		118	141	165	189
12.0	360	396	432	504	576		120	144	168	192
12.2	372	409	447	522	595		122	146	171	195
12.4	385	424	462	539	615		124	149	173	199
12.6	397	437	477	557	635		126	151	176	202
12.8	410	451	492	574	655		128	153	179	205
13.0	422	465	507	592	676		130	156	182	208
13.2	436	479	523	610	697		132	158	185	211
13.4	449	494	539	629	718		134	161	187	215
13.6	463	509	555	648	740		136	163	190	218
13.8	476	523	571	667	762		138	166	193	221
14.0	490	539	588	686	784		140	168	196	224
14.2	505	555	605	706	807		142	170	199	227
14.4	519	570	622	726	829		144	173	202	230
14.6	534	586	639	746	853		146	175	204	234
14.8	548	602	657	767	876		148	178	207	237
15.0	563	619	675	788	900		150	180	210	240
15.2	578	635	693	809	924		152	182	213	243
15.4	594	653	711	830	949		154	185	216	246
15.6	609	669	730	852	973		156	187	218	250
15.8	625	687	749	874	999		158	190	221	253
16.0	640	704	768	896	1,024		160	192	224	256
16.2	656	722	787	919	1,050			194	227	259
16.4	673	740	807	942	1,076			197	230	262
16.6	689	758	827	965	1,102			199	232	266
16.8	706	776	847	988	1,129			202	235	269
17.0	723	795	867	1,012	1,156			204	238	272

See footnote at end of table.

Table 17 End areas in square feet of embankment sections for different side slopes and top widths 1/—Continued.

Fill height (ft)	Side slopes 2.5:1 2.5:1 / 2:1 3:1	2.5:1 3:1 / 2:1 3.5:1	3:1 3:1 / 2.5:1 3.5:1	3.5:1 3.5:1 / 3:1 4:1	4:1 4:1 / 3:1 5:1	Top width (ft) 8	10	12	14	16
17.2	740	814	888	1,036	1,183			206	241	275
17.4	757	833	909	1,060	1,211			209	244	278
17.6	774	852	930	1,084	1,239			211	246	282
17.8	792	871	951	1,109	1,267			214	249	285
18.0	810	891	972	1,134	1,296			216	252	288
18.2	828	911	994	1,160	1,325			218	255	291
18.4	846	931	1,016	1,186	1,354			221	258	294
18.6	865	951	1,038	1,212	1,384			223	260	298
18.8	884	972	1,060	1,238	1,414			226	263	301
19.0	903	993	1,083	1,264	1,444			228	266	304
19.2	922	1,014	1,106	1,291	1,475			230	269	307
19.4	941	1,035	1,129	1,318	1,505			233	272	310
19.6	960	1,056	1,152	1,345	1,537			235	274	314
19.8	980	1,078	1,176	1,372	1,568			238	277	317
20.0	1,000	1,100	1,200	1,400	1,600			240	280	320
20.2	1,020	1,122	1,224	1,428	1,632			242	283	323
20.4	1,040	1,144	1,248	1,457	1,665			245	286	326
20.6	1,061	1,167	1,273	1,486	1,697			247	288	330
20.8	1,082	1,190	1,298	1,515	1,731			250	291	333
21.0	1,103	1,213	1,323	1,544	1,764			252	294	336
21.2	1,124	1,236	1,348	1,574	1,798			254	297	339
21.4	1,145	1,254	1,374	1,604	1,832			257	300	342
21.6	1,166	1,283	1,400	1,634	1,866			259	302	346
21.8	1,188	1,307	1,426	1,664	1,901			262	305	349
22.0	1,210	1,331	1,452	1,694	1,936			264	308	352
22.2	1,232	1,356	1,479	1,725	1,971			266	311	355
22.4	1,254	1,380	1,506	1,756	2,007			269	314	358
22.6	1,277	1,405	1,533	1,788	2,043			271	316	362
22.8	1,300	1,430	1,560	1,820	2,079			274	319	365
23.0	1,323	1,455	1,587	1,852	2,116			276	322	368

1/ To find the end area for any fill height, add square feet given under staked side slopes to that under the top width for total section. Example: 6.4-foot 3:1 front and back slopes, 14-foot top width —123 plus 89, or 212 square feet for the section. Any combination of slopes that adds to 5, 6, or 7 may be used. A combination of 3.5:1 front and 2.5:1 back gives the same results as 3:1 front and back.

Table 18 Volume of material needed for the earthfill

Station (ft)	Ground elevation (ft)	Fill height 1/ (ft)	End area 2/ (ft^2)	Sum of end areas (ft^2)	Distance (ft)	Double volume (ft^3)
0 + 50	35.0	0	0			
				44	18	792
+ 68	32.7	2.3	44			
				401	32	12,832
1 + 00	25.9	9.1	357			
				1,066	37	39,442
+ 37	21.5	13.5	709			
				1,564	16	25,024
+ 53	20.0	15.0	855			
				1,730	22	38,060
+ 75	19.8	15.2	875			
				1,781	25	44,525
2 + 00	19.5	15.5	906			
				1,730	19	32,870
+ 19	20.3	14.7	824			
				1,648	13	21,424
+ 32	20.3	14.7	824			
				1,805	4	7,220
+ 36	18.8	16.2	981			
				2,030	4	8,120
+ 40	18.2	16.8	1,049			
				2,064	3	6,192
+ 43	18.5	16.5	1,015			
				1,911	3	5,733
+ 46	19.6	15.4	896			
				1,771	13	23,023
+ 59	19.8	15.2	875			
				1,650	41	67,650
3 + 00	20.8	14.2	775			
				1,023	35	35,805
+ 35	27.7	7.3	248			
				324	25	8,100
+ 60	31.6	3.4	76			
				76	36	2,736
3 + 96	35.0	.0	0			
					Total	379,548 3/

1/ Elevation of top of dam without allowance for settlement.
2/ End areas based on 12-foot top width and 3:1 slopes on both sides.
3/ Divide double volume in cubic feet by 54 to obtain volume in cubic yards; for example,

$$\frac{379{,}548}{54} = 7{,}029\ yd^3$$

$$\text{Allowance for settlement (10\%)} = 703\ yd^3$$

$$\text{Total volume} = 7.732\ yd^3.$$

The sample volume estimate of 7,732 cubic yards includes only the volume of earth required to complete the dam itself. Estimate the volume of earth required to backfill the core trench, old stream channels, and other required excavation and add it to the estimate for the dam. Also include an estimate of additional fill to be placed on the backslope and abutments. For example, assume that, in addition to the volume shown in table 18, there is a cutoff trench to be backfilled. The dimensions of the trench are:

Average depth = 4.0 ft
Bottom width = 8.0 ft
Side slopes = 1.5:1
Length = 177 ft

Compute the volume of backfill as follows:

$$\text{End area} = \left[w + \left(z \times d \right) \right] d \qquad \text{[Eq. 4]}$$

$$\text{Volume} = \frac{\left(\text{End area} \times l \right)}{27} \qquad \text{[Eq. 5]}$$

where:
d = average depth
w = bottom width
l = length
z = side slopes

$$\text{End area} = [8 + (1.5 \times 4)]4 = 56 \text{ ft}^2$$

$$\text{Volume} = \frac{56 \times 177}{27} = 367 \text{ yd}^3$$

Add this to the volume required for the dam and the total volume is 7,732 plus 367, or 8,099 cubic yards. This 8,099 cubic yards represents the required compacted volume. To account for shrinkage resulting from compaction, a minimum of 1.5 times this amount is generally necessary to have available in the borrow areas and required excavations. In this example you need a minimum of 12,148 cubic yards available to construct the dam.

Drawings and specifications—Record on the engineering drawings all planning information that would affect the construction of the dam. These drawings should show all elevations and dimensions of the dam, the dimensions and extent of the cutoff trench and other areas requiring backfill, the location and dimensions of the principal spillway and other planned appurtenances, and any other pertinent information. The drawings should also include a list of the estimated quantity and kind of building materials required. The construction and material specifications state the extent and type of work, site specific details, material quality, and requirements for prefabricated materials.

Observe all land disturbance laws by including temporary protective measures during construction to minimize soil erosion and sedimentation.

Unless you have all the necessary equipment, you will need to employ a contractor to build the pond. You may wish to receive bids from several contractors to be sure that you are getting the job done at the lowest possible cost. A set of drawings and specifications shows what is to be done. This provides a basis for contractors to bid on the proposed work, allows fair competition among bidders, and states the conditions under which the work is to be done. The specifications should

- give all the information not shown on the drawings that is necessary to define what is to be done,
- prescribe how the work is to be done if such direction is required,
- specify the quality of material and workmanship required, and
- define the method of measurement and the unit of payment for the various items of work that constitute the whole job.

Construction work of the quality and standards desired will not result unless there is a clear understanding of these requirements between the owner and the contractor. For these reasons specifications should be prepared for all ponds for which the owners award the construction contracts.

Assistance in preparing drawings and specifications is available from your local soil conservation district, NRCS specialists, or private consultants.

Staking for construction

Each job must be adequately and clearly staked before construction is started. Staking transmits the information on the drawings to the job site. This information locates the work and provides the lines, grade, and elevations required for construction in accordance with the drawings. Consider the contractor's wishes in staking so that he can make the most effective use of the stakes. The quality and appearance of the completed job reflect the care used in staking. The staking should be done by an engineer or other qualified person.

The areas to be cleared generally consist of the dam site, the auxiliary spillway site, the borrow area, and the area over which water is to be impounded. Mark each area clearly with an adequate number of stakes. In the pond area, locate the proposed water line with a level and surveying rod. This provides a base line from which clearing limits can be established.

To locate the dam, set stakes along its centerline at intervals of 100 feet or less. (Generally this has been done during the initial planning survey.) Then set the fill and slope stakes upstream and downstream from the centerline stakes to mark the points of intersection of the side slopes with the ground surface and to mark the work area limits of construction. These stakes also establish the height of the dam.

To locate the earth auxiliary spillway, first stake the centerline and then set cut and slope stakes along the lines of intersection of the spillway side slopes with the natural ground surface.

If fill material must be obtained from a borrow area, this area must be clearly marked. Set cut stakes to indicate the depth to which the contractor can excavate to stay within the limits of suitable material, as indicated by soil borings. This allows the borrow area to drain readily and marks the limits of construction.

Set stakes to show the centerline location of the principal spillway after foundation preparation has reached the point at which the stakes will not be disturbed. Locate the pipe where it will rest on a firm foundation. Mark the stakes to show cuts from the top of the stakes to the grade elevation of the pipe. With additional stakes, mark the location of the riser, drainage gate, filter and drainage diaphragm or antiseep collars, outlet structures, and other appurtenances.

Building the pond

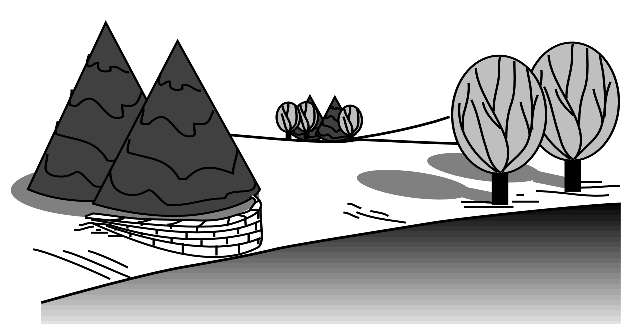
Attention to the details of construction and adherence to the drawings and specifications are as important as adequate investigation and design. Careless and shoddy construction can make an entirely safe and adequate design worthless and cause failure of the dam. Adherence to specifications and prescribed construction methods becomes increasingly important as the size of the structure and the failure hazards increase. Good construction is important regardless of size, and the cost is generally less in the long run than it is for dams built carelessly.

Clearing and grubbing—Clear the foundation area and excavated earth spillway site of trees and brush. In some states this is required by statute. Cut trees and brush as nearly flush with the ground as practicable and remove them and any other debris from the dam site. Should you or your contractor elect to uproot the trees with a bulldozer, you must determine if the tree roots extend into pervious material and if the resultant holes will cause excessive seepage. If so, fill the holes by placing suitable material in layers and compact each layer by compacting or tamping.

All material cleared and grubbed from the pond site, from the earth spillway and borrow areas, and from the site of the dam itself should be disposed of. This can be done by burning, burying under 2 feet of soil, or burying in a disposal area, such as a sanitary landfill.

Minimal clearing conserves site character and minimizes the difficulty and expense of reestablishing vegetation. Confine clearing limits to the immediate construction areas to avoid unnecessary disturbance.

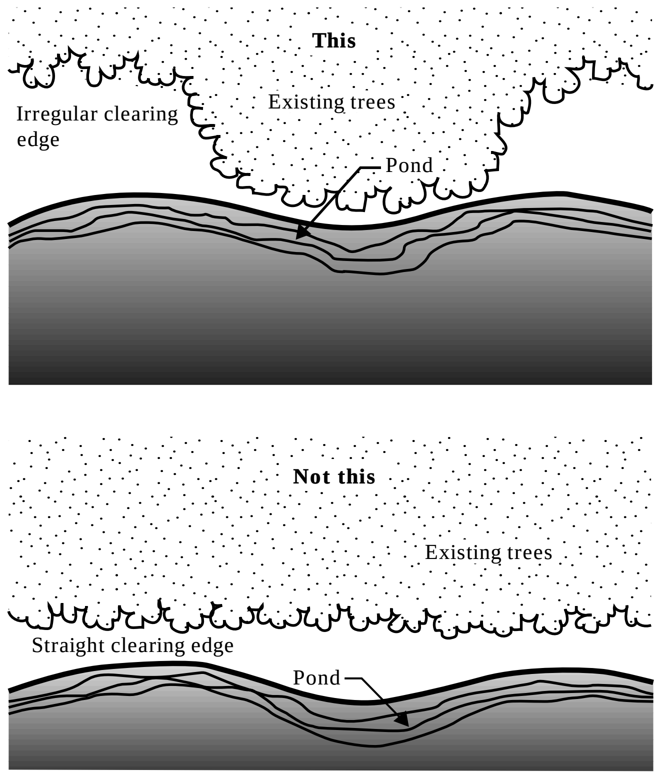
Figure 30 A tree well preserves vegetation



Removing all vegetation within the construction limits is not always necessary. Selected groupings of desirable plants can be kept. Trees and shrubs can often survive a 1- to 2-foot layer of graded fill over their root systems or they can be root-pruned in excavated areas. Tree wells and raised beds can also be used to retain vegetation (fig. 30).

Clearing limits should be irregular to create a natural-appearing edge and open area (fig. 31). Further transition with vegetated surroundings can be accomplished by feathering clearing edges. Density and height of vegetation can be increased progressively from the water's edge to the undisturbed vegetation (fig. 32). Feathering can be accomplished by selective clearing, installation of new plants, or both.

Figure 31 Irregular clearing around the pond helps create a natural appearing edge

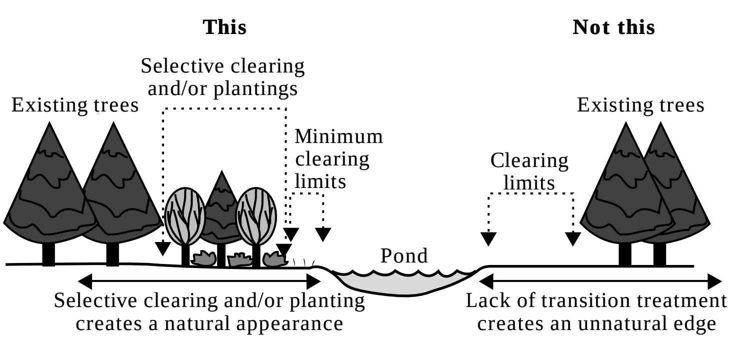


Preparing the foundation—Preparing the foundation includes treating the surface, excavating and backfilling the cutoff trench, and excavating and backfilling existing stream channels. If the foundation has an adequate layer of impervious material at the surface or if it must be blanketed by such a layer, you can eliminate the cutoff trench. Remove sod, boulders, and topsoil from the entire area over which the embankment is to be placed. This operation is best performed by using a tractor-pulled or self-propelled wheeled scraper. The topsoil should be stockpiled temporarily for later use on the site.

Fill all holes in the foundation area, both natural and those resulting from grubbing operations, with suitable fill material from borrow areas. Use the same method of placement and compaction as used to build the dam. Where necessary use hand or power tampers in areas not readily accessible to other compacting equipment.

After filling the holes, thoroughly break the ground surface and turn it to a depth of 6 inches. Roughly level the surface with a disk harrow and then compact it so that the surface materials of the foundation are as well compacted as the subsequent layers of the fill. Dig the cutoff trench to the depth, bottom width, and side slopes shown on the drawings. Often the depths shown on the drawings are only approximate; you

Figure 32 Feathering vegetation at the pond's edge makes a natural transition with existing vegetation



need to inspect the completed trench before backfilling to be sure that it is excavated at least 12 inches into impervious material throughout its entire length.

Material removed from the trench can be placed in the downstream third of the dam and compacted in the same manner as the earthfill if the material is free of boulders, roots, organic matter, and other objectionable material.

A dragline excavator and a tractor-pulled or self-propelled wheeled scraper are the most satisfactory equipment for excavating cutoff trenches. Before backfilling operations are attempted, pump all free water from the cutoff trench. Some material high in clay content takes up more than twice its own weight of water and becomes a soggy mass. Such clay puddled in the cutoff of a dam may require many years to become stable. Also, in drying it contracts and may leave cracks that can produce a roof of the overlying impervious earthfill section and provide passageways for seepage through the dam.

Backfill the cutoff trench to the natural ground surface with suitable fill material from designated borrow areas. Place the backfill material in thin layers and compact it by the same methods used to build the dam.

Deepen, slope back, and widen stream channels that cross the embankment foundation. This is often necessary to remove all stones, gravel, sand, sediment, stumps, roots, organic matter, and any other objectionable material that could interfere with proper bonding of the earthfill with the foundation. Leave side slopes of the excavated channels no steeper than 3:1 when the channels cross the embankment centerline. If the channels are parallel to the centerline, leave the side slopes no steeper than 1:1. Backfill these channels as recommended for the cutoff trench.

Installing the pipe spillway—Install the pipe, riser (if applicable), filter and drainage diaphragm or antiseep collars, trash rack, and other mechanical components of the dam to the lines and grades shown on the drawings and staked at the site. To minimize the danger of cracks or openings at the joints caused by unequal settlement of the foundation, place all pipes and other conduits on a firm foundation.

Install pipes and filter and drainage diaphragm or antiseep collars and tamp the selected backfill material around the entire structure before placing the earthfill for the dam. The same procedure applies to all other pipes or conduits.

Excavating the earth spillway—The completed spillway excavation should conform as closely as possible to the lines, grades, bottom width, and side slopes shown on the drawings and staked at the site. Leave the channel bottom transversely level to prevent meandering and the resultant scour within the channel during periods of low flow. If it becomes necessary to fill low places or depressions in the channel bottom caused by undercutting the established grade, fill them to the established grade by placing suitable material in 8-inch layers and compacting each layer under the same moisture conditions regardless of the placement in or under the embankment.

Building the dam—Clear the dam and spillway area of trees, brush, stumps, boulders, sod, and rubbish. The sod and topsoil can be stockpiled and used later to cover the dam and spillway (fig. 33). This will help when vegetation is established. Get suitable fill material from previously selected borrow areas and from sites of planned excavation. The material should be free of sod, roots, stones more than 6 inches in diameter, and any material that could prevent the desired degree of compaction. Do not use frozen material or place fill material on frozen foundations.

Selected backfill material should be placed in the core trench and around pipes and antiseep collars, when used. The material should be compacted by hand tamping or manually directed power tampers around pipes. Begin placing fill material at the lowest point and bring it up in horizontal layers, longitudinal to the centerline of dam, approximately 6 inches thick. For fill placement around risers, pipes and filter, and drainage diaphragms, the horizontal layers should be approximately 4 inches thick. Do not place fill in standing water. The moisture content is adequate for compaction when the material can be formed into a firm ball that sticks together and remains intact when the hand is vibrated violently and no free water appears. If the material can be formed into a firm ball that sticks together, the moisture content is adequate for compaction. Laboratory tests of the fill material and field testing of the soil for moisture and compaction may be necessary for large ponds or special conditions.

If the material varies in texture and gradation, use the more impervious (clay) material in the core trench, center, and upstream parts of the dam. Construction equipment can be used to compact earthfill in an ordinary pond dam. Equipment that has rubber tires can be routed so each layer is sufficiently covered by tire tracks. For dams over 20 feet high, special equipment, such as sheepsfoot rollers, should be used.

Figure 33 The sod and topsoil in a pond construction area can be stockpiled for later use

Excavated ponds

Excavated ponds are the simplest to build in relatively flat terrain. Because their capacity is obtained almost solely by excavation, their practical size is limited. They are best suited to locations where the demand for water is small. Because excavated ponds can be built to expose a minimum water surface area in proportion to their volume, they are advantageous in places where evaporation losses are high and water is scarce. The ease with which they can be constructed, their compactness, their relative safety from flood-flow damage, and their low maintenance requirements make them popular in many sections of the country.

Two kinds of excavated ponds are possible. One is fed by surface runoff and the other is fed by ground water aquifers, usually layers of sand and gravel. Some ponds may be fed from both of these sources.

The general location of an excavated pond depends largely on the purpose or purposes for which the water is to be used and on other factors discussed previously in this handbook. The specific location is often influenced by topography. Excavated ponds fed by surface runoff can be located in almost any kind of topography. They are, however, most satisfactory and most commonly used in areas of comparatively flat, but well-drained terrain. A pond can be located in a broad natural drainageway or to one side of a drainageway if the runoff can be diverted into the pond. The low point of a natural depression is often a good location. After the pond is filled, excess runoff escapes through regular drainageways.

Excavated ponds fed by ground water aquifers can be located only in areas of flat or nearly flat topography. If possible, they should be located where the permanent water table is within a few feet of the surface.

Soils

If an excavated pond is to be fed by surface runoff, enough impervious soil at the site is essential to avoid excess seepage losses. The most desirable sites are where fine-textured clay and silty clay extend well below the proposed pond depth. Sites where sandy clay extends to adequate depths generally are satisfactory. Avoid sites where the soil is porous or is underlain by strata of coarse-textured sand or sand-gravel mixtures unless you are prepared to bear the expense of an artificial lining. Avoid soil underlain by limestone containing crevices, sinks, or channels.

The performance of nearby ponds that are fed by runoff and in a similar soil is a good indicator of the suitability of a proposed site. Supplement such observations of existing ponds by boring enough test holes at intervals over the proposed pond site to determine accurately the kind of material there. You can get some indication of permeability by filling the test holes with water. The seepage indicates what to expect of a pond excavated in the same kind of material.

If an excavated pond is to be fed from a water-bearing sand or a sand-gravel layer, the layer must be at a depth that can be reached practically and economically by the excavating equipment. This depth seldom exceeds 20 feet. The water-bearing layer must be thick enough and permeable enough to yield water at a rate that satisfies the maximum expected demand for water and overcomes evaporation losses.

Thoroughly investigate sites proposed for aquifer-fed excavated ponds. Bore test holes at intervals over the site to determine the existence and physical characteristics of the water-bearing material. The water level in the test holes indicates the normal water level in the completed pond. The vertical distance between this level and the ground surface determines the volume of overburden or excavation needed that does not contribute to the usable pond capacity, but may increase the construction cost considerably. From an economic standpoint, this vertical distance between water level and ground surface generally should not exceed 6 feet.

Check the rate at which the water rises in the test holes. A rapid rate of rise indicates a high-yielding aquifer. If water is removed from the pond at a rapid rate, as for irrigation, the water can be expected to return to its normal level within a short time after removal has ceased. A slow rate of rise in the test holes indicates a low-yielding aquifer and a slow rate of recovery in the pond. Check the test hole during drier seasons to avoid being misled by a high water table that is only temporary.

Spillway and inlet requirements

If you locate an excavated pond fed by surface runoff on sloping terrain, you can use a part of the excavated material for a small low dam around the lower end and sides of the pond to increase its capacity. You need an auxiliary spillway to pass excess storm runoff around the small dam. Follow the procedures for planning the spillway and provide protection against erosion as discussed in the *Excavating the earth spillway* section.

Ponds excavated in areas of flat terrain generally require constructed spillways. If surface runoff must enter an excavated pond through a channel or ditch rather than through a broad shallow drainageway, the overfall from the ditch bottom to the bottom of the pond can create a serious erosion problem unless the ditch is protected. Scouring can occur in the side slope of the pond and for a considerable distance upstream in the ditch. The resulting sediment tends to reduce the depth and capacity of the pond. Protect the slope by placing one or more lengths of rigid pipe in the ditch and extending them over the side slope of the excavation. The extended part of the pipe or pipes can be cantilevered or supported with timbers. The diameter of the pipes depends on the peak rate of runoff that can be expected from a 10-year frequency storm. If you need more than one pipe inlet, the combined capacity should equal or exceed the estimated peak rate of runoff.

Pipe diameter [1/] (in)	Pond inflow Q (ft^3/s)
15	0 to 6
18	6 to 9
21	9 to 13
24	13 to 18
30	18 to 30
36	30 to 46
42	46 to 67
48	67 to 92
54	92 to 122
60	122 to 157

1/ Based on a free outlet and a minimum pipe slope of 1 percent with the water level 0.5 foot above the top of the pipe at the upstream end.

In areas where a considerable amount of silt is carried by the inflowing water, you should provide a desilting area or filterstrip in the drainageway immediately above the pond to remove the silt before it enters the pond. This area or strip should be as wide as or somewhat wider than the pond and 100 feet or more long. After you prepare a seedbed, fertilize, and seed the area to an appropriate mix of grasses and forbs. As the water flows through the vegetation, the silt settles out and the water entering the pond is relatively silt free.

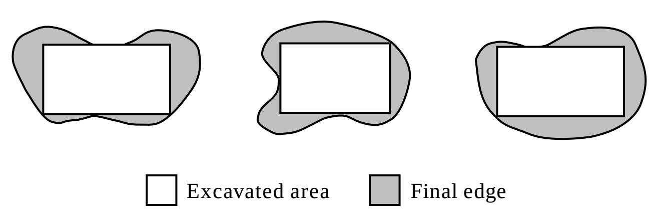
Planning the pond

Although excavated ponds can be built to almost any shape desired, a rectangle is commonly used in relatively flat terrain. The rectangular shape is popular because it is simple to build and can be adapted to all kinds of excavating equipment.

Rectangular ponds should not be constructed, however, where the resulting shape would be in sharp contrast to surrounding topography and landscape patterns. A pond can be excavated in a rectangular form and the edge shaped later with a blade scraper to create an irregular configuration (fig. 34).

The capacity of an excavated pond fed by surface runoff is determined largely by the purpose or purposes for which water is needed and by the amount of inflow that can be expected in a given period. The required capacity of an excavated pond fed by an underground waterbearing layer is difficult to determine because the rate of inflow into the pond can seldom be estimated accurately. For this reason, the pond should be built so that it can be enlarged if the original capacity proves inadequate.

Figure 34 Geometric excavation graded to create more natural configuration



Selecting the dimensions—The dimensions selected for an excavated pond depend on the required capacity. Of the three dimensions of a pond, the most important is depth. All excavated ponds should have a depth equal to or greater than the minimum required for the specific location. If an excavated pond is fed from ground water, it should be deep enough to reach well into the waterbearing material. The maximum depth is generally determined by the kind of material excavated and the type of equipment used.

The type and size of the excavating equipment can limit the width of an excavated pond. For example, if a dragline excavator is used, the length of the boom usually determines the maximum width of excavation that can be made with proper placement of the waste material.

The minimum length of the pond is determined by the required pond capacity.

To prevent sloughing, the side slopes of the pond are generally no steeper than the natural angle of repose of the material being excavated. This angle varies with different soils, but for most ponds the side slopes are 1:1 or flatter (fig. 35).

If the pond is to be used for watering livestock, provide a ramp with a flat slope (4:1 or flatter) for access. Regardless of the intended use of the water, these flat slopes are necessary if certain types of excavating equipment are used. Tractor-pulled wheeled scrapers and bulldozers require a flat slope to move material from the bottom of the excavation.

Estimating the volume—After you have selected the dimensions and side slopes of the pond, estimate the volume of excavation required. This estimate determines the cost of the pond and is a basis for inviting bids and for making payment if the work is to be done by a contractor.

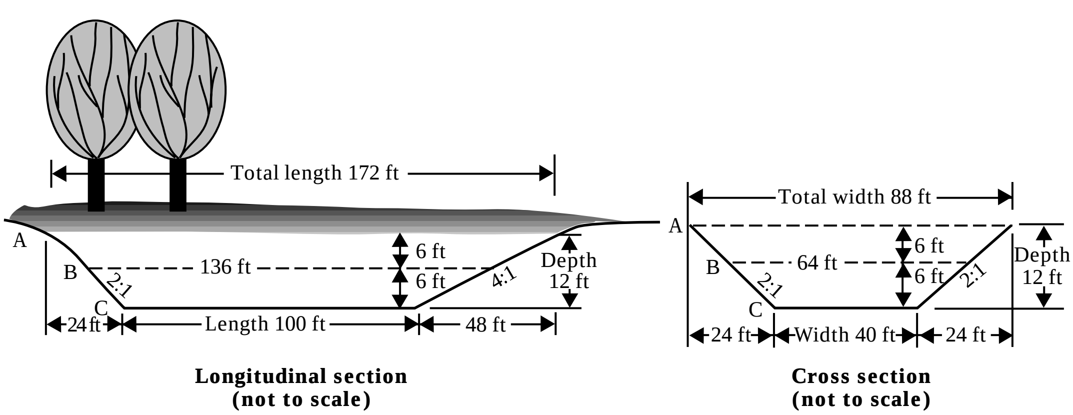
The volume of excavation required can be estimated with enough accuracy by using the prismoidal formula:

$$V = \frac{(A + 4B + C)}{6} \times \frac{D}{27} \qquad \text{[Eq. 6]}$$

where:

- V = volume of excavation (yd^3)
- A = area of the excavation at the ground surface (ft^2)
- B = area of the excavation at the mid-depth (1/2 D) point (ft^2)
- C = area of the excavation at the bottom of the pond (ft^2)
- D = average depth of the pond (ft^2)
- 27 = factor converting cubic feet to cubic yards

Figure 35 Typical sections of an excavated pond



As an example, assume a pond with a depth, *D*, of 12 feet, a bottom width, *W*, of 40 feet, and a bottom length, *L*, of 100 feet as shown in figure 35. The side slope at the ramp end is 4:1, and the remaining slopes are 2:1. The volume of excavation, *V*, is computed as follows:

$$A = 88 \times 172 = 15{,}136$$
$$4B = 4(64 \times 136) = 34{,}816$$
$$C = 40 \times 100 = 4{,}000$$
$$(A + 4B + C) = 53{,}952$$

Then

$$V = \frac{53{,}952}{6} \times \frac{12}{27} = 3{,}996 \text{ yd}^3$$

If the normal water level in the pond is at the ground surface, the volume of water that can be stored in the pond is 3,996 cubic yards times 0.00061963, or 2.48 acre-feet. To convert to gallons, 3,996 cubic yards multiplied by 201.97 equals 807,072 gallons. The sample procedure is used to compute the volume of water that can be stored in the pond if the normal water level is below the ground surface. The value assigned to the depth D is the actual depth of the water in the pond rather than depth of excavation.

A summary of methods for estimating the volume of an excavated pond is provided in appendix A. This summary information is reprinted from NRCS (formerly SCS) Landscape Architecture Note No. 2, Landscape Design: Ponds, September 2, 1988.

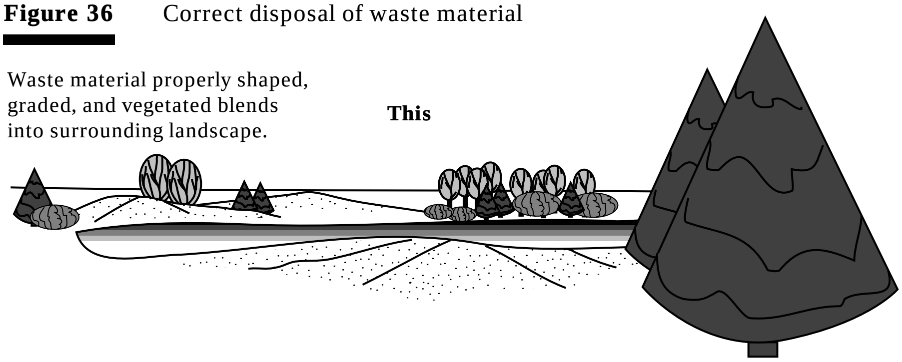
Waste material—Plan the placement or disposal of the material excavated from the pond in advance of construction operations. Adequate placement prolongs the useful life of the pond, improves its appearance, and facilitates maintenance and establishment of vegetation. The waste material can be stacked, spread, or removed from the site as conditions, nature of the material, and other circumstances warrant.

If you do not remove the waste material from the site, place it so that its weight does not endanger the stability of the side slopes and rainfall does not wash the material back into the pond. If you stack the material, place it with side slopes no steeper than the natural angle of repose of the soil. Do not stack waste material in a geometric mound, but shape and spread it to blend with natural landforms in the area. Because many excavated ponds are in flat terrain, the waste material may be the most conspicuous feature in the landscape. Avoid interrupting the existing horizon line with the top of the waste mound (fig. 36).

Figure 36 Correct disposal of waste material

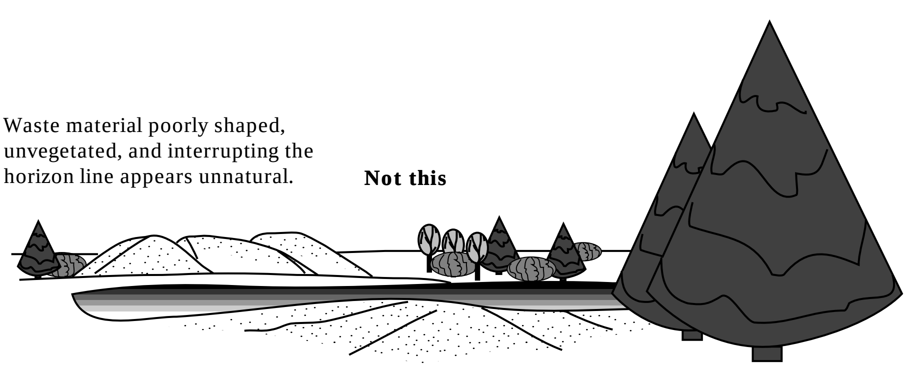
Waste material properly shaped, graded, and vegetated blends into surrounding landscape.

This



Waste material poorly shaped, unvegetated, and interrupting the horizon line appears unnatural.

Not this



Waste material can also be located and designed to be functional. It can screen undesirable views, buffer noise and wind, or improve the site's suitability for recreation (fig. 37). In shaping the material, the toe of the fill must be at least 12 feet from the edge of the pond. In the Great Plains you can place the waste material on the windward side of the pond to serve as a snow fence for collecting drifts in the pond. These banks can also reduce evaporation losses by breaking the force of prevailing winds across the pond.

Perhaps the most satisfactory method of handling waste material is to remove it from the site. Complete removal, however, is expensive and can seldom be justified unless the material is needed nearby. Waste material can sometimes be used advantageously for filling nearby low areas in a field or in building farm roads. If state or county highway maintenance crews need such material, you may be able to have them remove it.

Building the pond

Clear the pond area of all undesired vegetation. Mark the outside limits of the proposed excavation with stakes. On the stakes indicate the depth of cut from the ground surface to the pond bottom.

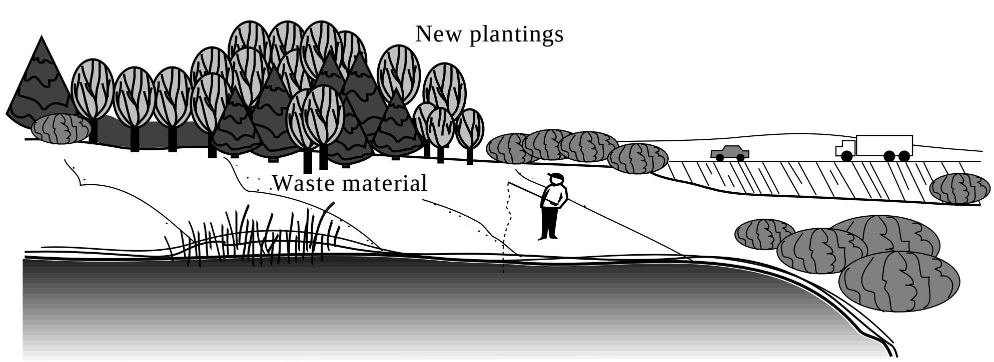
Excavation and placement of the waste material are the principal items of work in building this type pond. The kind of excavating equipment used depends on the climatic and physical conditions at the site and on what equipment is available.

In low-rainfall areas where water is unlikely to accumulate in the excavation, you can use almost any kind of available equipment. Tractor-pulled wheeled scrapers, dragline excavators, and track-type tractors equipped with a bulldozer blade are generally used. Bulldozers can only push the excavated material, not carry it; if the length of push is long, using these machines is expensive.

In high-rainfall areas and in areas where the water table is within the limits of excavation, a dragline excavator is commonly used because it is the only kind of equipment that operates satisfactorily in any appreciable depth of water. For ponds fed by ground water aquifers, a dragline is normally used to excavate the basic pond.

Excavate and place the waste material as close as possible to the lines and grades staked on the site. If you use a dragline excavator, you generally need other kinds of equipment to stack or spread the waste material and shape the edge to an irregular configuration. Bulldozers are most commonly used. Graders, either tractor-pulled or self-propelled, can be used to good advantage, particularly if the waste material is to be shaped.

Figure 37 Waste material and plantings separate the pond from a major highway



Sealing the pond

Excessive seepage in ponds is generally because the site is poor; that is, one where the soils in the impounding area are too permeable to hold water. Selecting a poor site is often the result of inadequate site investigations and could have been avoided. In some places no satisfactory site is available, but the need for water is great enough to justify using a site that is somewhat less than satisfactory. In this case the original pond design must include plans for reducing seepage by sealing (fig. 38). In some places excessive removal of the soil mantle during construction, usually to provide material for the embankment, exposes highly pervious material, such as sand, gravel, or rock containing cracks, crevices, or channels. This can be avoided by carefully selecting the source of embankment material.

To prevent excessive seepage, reduce the permeability of the soils to a point at which losses are insignificant or at least tolerable. The method depends largely on the proportions of coarse-grained sand and gravel and of fine-grained clay and silt in the soil.

Compaction

Some pond areas can be made relatively impervious by compaction alone if the material contains a wide range of particle sizes (small gravel or coarse sand to fine sand) and enough clay (10 percent or more) and silt to effect a seal. This is the least expensive method of those presented in this handbook. Its use, however, is limited to these soil conditions as well as by the depth of water to be impounded.

The procedure is simple. Clear the pond area of all trees and other vegetation. Fill all stump holes, crevices, and similar areas with impervious material. Scarify the soil to a depth of 16 to 18 inches with a disk, rototiller, pulverizer, or similar equipment. Remove all rocks and tree roots. Roll the loosened soil under optimum moisture conditions in a dense, tight layer with four to six passes of a sheepsfoot roller in the same manner as for compacting earth embankments.

Make the compacted seal no less than 12 inches thick where less than 10 feet of water is to be impounded. Because seepage losses vary directly with the depth of water impounded over an area, increase the thickness of the compacted seal proportionately if the depth of

Figure 38 Disking in chemical additive to seal a pond

water impounded exceeds 10 feet or more. The thickness of the compacted seal can be determined using equation 7.

$$d = \frac{k \times H}{(v - k)} \qquad \text{[Eq. 7]}$$

where:

d = thickness of compacted seal

k = coefficient of permeability of compacted seal, which is assumed to be 0.003 fpd unless testing is done

H = water depth

v = allowable specific discharge which is assumed to be 0.028 fpd unless otherwise specified

As an example, assume a pond with a depth, H, of 12 feet. No soil samples were taken for laboratory testing. Therefore, use the assumed values for k and v. Calculate the required minimum thickness of the compacted seal. Using the preceding equation:

$$d = \frac{0.003\,fpd \times 12\,ft}{0.028\,fpd - 0.003\,fpd}$$
$$= 1.4 \text{ ft}$$

If soil samples were taken and permeability tests were performed on the material of the compacted seal at the density it is to be placed, a thickness less than what was calculated may be possible. Without knowing whether the soil underlying the compacted layer will act as a filter for the compacted layer, the minimum thickness should never be less than 12 inches.

Compact the soils in two or more layers not exceeding 9 inches uncompacted over the area. Remove and stockpile the top layer or layers while the bottom layer is being compacted.

Clay blankets

Pond areas containing high percentages of coarse-grained soils, but lacking enough clay to prevent excessive seepage, can be sealed by blanketing. Blanket the entire area over which water is to be impounded as well as the upstream slope of the embankment. The blanket should consist of a well-graded material containing at least 20 percent clay. The requirements for good blanket material are about the same as those described for earth embankments. You can usually obtain material for the blanket from a borrow area close enough to the pond to permit hauling at a reasonable cost.

Thickness of the blanket depends on the depth of water to be impounded. The minimum compacted thickness is 12 inches for all depths of water under 10 feet. Increase this thickness by 2 inches for each foot of water over 10 feet and above.

Construction is similar to that for earth embankments. Remove all trees and other vegetation and fill all holes and crevices before hauling earth material from the borrow area to the pond site in tractor-pulled wheeled scrapers or similar equipment. Spread the material uniformly over the area in layers 6 to 8 inches thick. Compact each layer thoroughly, under optimum moisture conditions, by four to six passes of a sheepsfoot roller before placing the next layer.

Protect clay blankets against cracking that results from drying and against rupture caused by freezing and thawing. Spread a cover of gravel 12 to 16 inches thick over the blanket below the anticipated high water level. Use rock riprap or other suitable material to protect areas where the waterflow into the pond is concentrated.

Bentonite

Adding bentonite is another method of reducing excessive seepage in soils containing high percentages of coarse-grained particles and not enough clay. Bentonite is a fine-textured colloidal clay. When wet it absorbs several times its own weight of water and, at complete saturation, swells as much as 8 to 20 times its original volume. Mixed in the correct proportions with well-graded coarse-grained material, thoroughly compacted and then saturated, the particles of bentonite swell until they fill the pores to the point that the mixture is nearly impervious to water. On drying, however, bentonite returns to its original volume leaving cracks. For this reason, sealing with bentonite usually is not recommended for ponds in which the water level is expected to fluctuate widely. A laboratory analysis of the pond area material to determine the rate of application is essential.

Before selecting this method of sealing a pond, locate the nearest satisfactory source of bentonite and investigate the freight rates. If the source is far from the pond site, the cost may prohibit the use of bentonite.

As with other methods, clear the pond area of all vegetation. Fill all holes or crevices, and cover and compact areas of exposed gravel with suitable fill material.

The soil moisture level in the area to be treated is important. Investigate it before applying bentonite. The moisture level should be optimum for good compaction. If the area is too wet, postpone sealing until moisture conditions are satisfactory. If it is too dry, add water by sprinkling.

Spread the bentonite carefully and uniformly over the area to be treated at the rate determined by the laboratory analysis. This rate usually is 1 to 3 pounds per square foot of area. Thoroughly mix the bentonite with the surface soil to a depth that will result in a 6-inch compacted layer. This generally is an uncompacted thickness of approximately 8 to 9 inches. A rototiller is best for this operation, but a disk or similar equipment can be used. Then compact the area with four to six passes of a sheepsfoot roller.

If considerable time elapses between applying the bentonite and filling the pond, protecting the treated area against drying and cracking may be necessary. A mulch of straw or hay pinned to the surface by the final passes of the sheepsfoot roller gives this protection. Use rock riprap or other suitable material to protect areas where water inflow into the treated area is concentrated.

Chemical additives

Because of the structure or arrangement of the clay particles, seepage is often excessive in fine-grained clay soils. If these particles are arranged at random with end-to-plate or end-to-end contacts, they form an open, porous, or honeycomb structure; the soil is said to be aggregated. Applying small amounts of certain chemicals to these porous aggregates may result in collapse of the open structure and rearrangement of the clay particles. This dispersed structure reduces soil permeability. The chemicals used are called dispersing agents.

The soils in the pond area should contain more than 50 percent fine-grained material (silt and clay) and at least 15 percent clay for chemical treatment to be effective. Chemical treatment is not effective in coarse-grained soils.

Although many soluble salts are dispersing agents, sodium polyphosphates and sodium chloride (common salt) are most commonly used. Of the sodium polyphosphates, tetrasodium pyrophosphate and sodium tripolyphosphate are most effective. Soda ash, technical grade 99 to 100 percent sodium carbonate, can also be used. Sodium polyphosphates generally are applied at a rate of 0.05 to 0.10 pound per square foot, and sodium chloride at a rate of 0.20 to 0.33 pound per square foot. Soda ash is applied at a rate of 0.10 to 0.20 pound per square foot. A laboratory analysis of the soil in the pond area is essential to determine which dispersing agent will be most effective and to determine the rate at which it should be applied.

Mix the dispersing agent with the surface soil and then compact it to form a blanket. Thickness of the blanket depends on the depth of water to be impounded. For water less than 10 feet deep, the compacted blanket should be at least 12 inches thick. For greater depths, the thickness should be increased at the rate of 2 inches per foot of water depth from 10 feet and above.

The soil moisture level in the area to be treated should be near the optimum level for good compaction. If the soil is too wet, postpone treatment. Polyphosphates release water from soil, and the material may become too wet to handle. If the soil is too dry, add water by sprinkling.

Clear the area to be treated of all vegetation and trash. Cover rock outcrops and other exposed areas of highly permeable material with 2 to 3 feet of fine-grained material. Thoroughly compact this material. In cavernous limestone areas, the success or failure of the seal may depend on the thickness and compaction of this initial blanket.

Apply the dispersing agent uniformly over the pond area at a rate determined by laboratory analysis. It can be applied with a seeder, drill, fertilizer spreader, or by hand broadcasting. The dispersant should be finely granular, with at least 95 percent passing a No. 30 sieve and less than 5 percent passing a No. 100 sieve.

Thoroughly mix the dispersing agent into each 6-inch layer to be treated. You can use a disk, rototiller, pulverizer, or similar equipment. Operating the mixing equipment in two directions produces best results. Thoroughly compact each chemically treated layer with four to six passes of a sheepsfoot roller.

Protect the treated blanket against puncturing by livestock. Cover the area near the high-water line with a 12- to 18-inch blanket of gravel or other suitable material to protect it against erosion. Use riprap or other suitable material in areas where inflow into the pond is concentrated.

Waterproof linings

Using waterproof linings is another method of reducing excessive seepage in both coarse-grained and fine-grained soils. Polyethylene, vinyl, butyl-rubber membranes, and asphalt-sealed fabric liners are gaining wide acceptance as linings for ponds because they virtually eliminate seepage if properly installed.

Thin films of these materials are structurally weak, but if not broken or punctured they are almost completely watertight. Black polyethylene films are less expensive and have better aging properties than vinyl. Vinyl, on the other hand, is more resistant to impact damage and is readily seamed and patched with a solvent cement. Polyethylene can be joined or patched with a special cement.

All plastic membranes should have a cover of earth or earth and gravel not less than 6 inches thick to protect against punctures. Butyl-rubber membranes need not be covered except in areas traveled by livestock. In these areas a minimum 9-inch cover should be used on all types of flexible membranes. The bottom 3 inches of cover should be no coarser than silty sand.

Clear the pond area of all undesired vegetation. Fill all holes and remove roots, sharp stones, or other objects that might puncture the film. If the material is stony or of very coarse texture, cover it with a cushion layer of fine-textured material before placing the lining.

Some plants may penetrate both vinyl and polyethylene film. If nutgrass, johnsongrass, quackgrass, and other plants having high penetration are present, the subgrade, especially the side slopes, should be sterilized. Several good chemical sterilizers are available commercially. Sterilization is not required for covered butyl-rubber linings 20 to 30 mils thick.

Lay the linings in sections or strips, allowing a 6-inch overlap for seaming. Vinyl and butyl-rubber linings should be smooth, but slack. Polyethylene should have up to 10 percent slack. Be extremely careful to avoid punctures. Anchor the top of the lining by burying it in a trench dug completely around the pond at or above the normal water level. The anchor trench should be 8 to 10 inches deep and about 12 inches wide.

Establishing vegetation

Trees, shrubs, grasses, and forbs should be planted during or soon after construction. Their functions include erosion control, screening, space definition, climate control, and wildlife habitat. The vegetation should be able to survive under prevailing conditions with minimum maintenance. Native varieties are preferred for new plantings.

In many areas the exposed surface of the dam, the auxiliary spillway, and the borrow areas as well as other disturbed surfaces can be protected from erosion by establishing a vegetative community of appropriate species. Prepare a seedbed as soon after construction as practicable. This is generally done by disking or harrowing. Fertilize and seed with mixtures of perennial grasses and forbs appropriate for local soil and climatic conditions. If construction is completed when the soils are too dry for the seeds to germinate, irrigate the soils to ensure prompt germination and continued growth. Mulching with a thin layer of straw, fodder, old hay, asphalt, or one of several commercially manufactured materials may be desirable. Mulching not only protects the newly prepared seedbed, seeds, or small plants from rainfall damage, but also conserves moisture and provides conditions favorable for germination and growth.

Soil bioengineering systems should be employed to establish woody vegetation where appropriate on the shorelines of ponds. The systems best suited to these conditions include live stakes, live fascines, brushmattresses, live siltation, and reed clumps. Additional information about these and other soil bioengineering systems is in Part 650, Engineering Field Handbook, chapters 16 and 18.

Trees and shrubs that remain or those planted along the shoreline will be subject to flooding, wave action, or a high water table. The ability to tolerate such drastic changes varies greatly among species. Flood tolerance and resistance to wave action depend on root density and the ability to regenerate from exposed roots.

A planting plan indicating the species and rate of application of the vegetation can be helpful in achieving the desired results. For information on recommended plants and grass mixtures, rates of fertilization, and mulching procedures, contact the local representatives of the Natural Resources Conservation Service or the county agent.

Protecting the pond

Construction of the pond is not complete until you have provided protection against erosion, wave action, trampling by livestock, and any other source of damage. Ponds without this protection may be short lived, and the cost of maintenance is usually high.

Leave borrow pits in condition to be planted so that the land can be used for grazing or some other purpose. Grade and shape the banks or side slopes of borrow pits to a slope that permits easy mowing, preferably no steeper than 4:1, and allows the graded area to blend with the landscape. It is often desirable to establish vegetation to make the borrow area compatible with undisturbed surroundings.

Grade all areas or pits from which borrow material has been obtained so they are well drained and do not permit stagnant water to accumulate as breeding places for mosquitoes.

Wave action

Several methods are available to protect the upstream face of a dam against wave action. The choice of method depends on whether the normal pool level remains fairly constant or fluctuates. An irrigation pond is an example of the latter. In these ponds, water is withdrawn periodically during the growing season and the water level may fluctuate from normal pool level to near pond bottom one or more times each year. The degree of protection required also influences the choice of method.

Berms—If the water level in the pond is expected to remain fairly constant, a berm 6 to 10 feet wide located at normal pool level generally provides adequate protection against wave action. The berm should have a downward slope of about 6 to 12 inches toward the pond. The slope above the berm should be protected by vegetation.

Booms—Log booms also break up wave action. A boom consists of a single or double line of logs chained or cabled together and anchored to each end of the dam. Tie the logs end to end as close together as practicable. Leave enough slack in the line to allow the boom to adjust to fluctuating water levels. If you use double rows of logs, frame them together to act as a unit. For best results place the boom so that it floats about 6 feet upstream from the face of the dam. If the dam is built on a curve, you may need anchor posts on the face of the dam as well as at the ends to keep the boom from riding on the slope. Booms do not give as much protection as some other methods described, but they are inexpensive if timber is readily available. They generally are satisfactory for small structures.

Riprap—Rock riprap is an effective method of control if a high degree of protection is required or if the water level fluctuates widely. Riprap should extend from the top of the dam down the upstream face to a level at least 3 feet below the lowest anticipated water level. Riprap is dumped directly from trucks or other vehicles or is placed by hand. Hand placing gives more effective protection and requires less stone. Dumping requires more stone, but less labor. The layer of stones should be at least 12 inches thick and must be placed on a bed of gravel or crushed stone at least 10 inches thick. This bed keeps the waves from washing out the underlying embankment material that supports the riprap.

If riprap is not continuous to the upstream toe, provide a berm on the upstream face to support the layer of riprap and to keep it from sliding downslope. If possible, use stones whose color is similar to that in the immediate area. Allow grass and herbs to grow through the riprap to blend with surrounding vegetation, but control woody vegetation.

Livestock

Complete fencing of areas on which embankment ponds are built is recommended if livestock are grazed or fed in adjacent fields. Fencing provides the protection needed to develop and maintain a good plant cover on the dam, the auxiliary spillway, and in other areas. It enhances clean drinking water and eliminates damage or pollution by livestock. If you fence the entire area around the pond and use the pond for watering livestock, install a gravity-fed watering trough just downstream from the dam and outside the fenced area.

Fencing also enables you to establish an environment beneficial to wildlife. The marshy vegetation needed around ponds for satisfactory wildlife food and cover does not tolerate much trampling or grazing.

Not all ponds used for watering livestock need to be fenced. On some western and midwestern ranges, the advantages derived from fencing are more than offset by the increased cost and maintenance and the fact that fewer animals can water at one time. A rancher with many widely scattered ponds and extensive holdings must have simple installations that require minimum upkeep and inspection. Fencing critical parts of livestock watering ponds, particularly the earthfill and the auxiliary spillway, is usually advantageous even if complete fencing is impractical.

Operating and maintaining the pond

A pond, no matter how well planned and built, must be adequately maintained if its intended purposes are to be realized throughout its expected life. Lack of operation and maintenance has caused severe damage to many dams and spillways. Some structures have failed completely. For these reasons you must be fully aware of the need for adequate operation and maintenance, and you should carry out all measures required.

Inspect your pond periodically. Be sure to examine it after heavy rains to determine whether it is functioning properly or needs minor repairs. Repairing damage immediately generally eliminates the need for more costly repairs later. Damage may be small, but if neglected it may increase until repair becomes impractical and the entire structure must be replaced.

Fill any rills on the side slopes of the dam and any washes in the auxiliary spillway immediately with suitable material and compact it thoroughly. Fertilize as needed and reseed or resod these areas. If the upstream face of the earthfill shows signs of serious washing or sloughing because of wave action, install protective devices, such as booms or riprap. If seepage through or under the dam is evident, consult an engineer at once so that you can take proper corrective measures before serious damage occurs.

To maintain the protective plant cover on the dam and on the auxiliary spillway, mow it frequently and fertilize when needed. Mowing prevents the growth of woody plants where undesirable and helps develop a cover and root system more resistant to runoff. If the plant cover is protected by fencing, keep the fences in good repair.

Keep pipes, trash racks, outlet structures, valves, and watering troughs free of trash at all times.

In some localities burrowing animals such as badgers, gophers, beaver, and prairie dogs cause severe damage to dams or spillways. If this damage is not repaired, it may lead to failure of the dam. Using a submerged inlet or locating the inlet in deeper water discourages beavers from the pipe inlets. A heavy layer of sand or gravel on the fill discourages burrowing to some extent. Poultry netting can be used, but in time it rusts out and needs to be replaced.

Keep the water in your pond as clean and unpolluted as possible. Do not permit unnecessary trampling by livestock, particularly hogs. If fencing is not practical, pave the approaches to the pond with small rocks or gravel. Divert drainage from barn lots, feeding yards, bedding grounds, or any other source of contamination away from the pond. Clean water is especially important in ponds used for wildlife, recreation, and water supply.

In areas where surface water encourages mosquito breeding, stock the pond with topfeeding fish. Gambusia minnows are particularly effective in controlling mosquitoes. In malaria areas, do not keep any aquatic growth or shoreline vegetation and take special precautions in planning, building, and operating and maintaining the pond. Most states in malaria areas have health regulations covering these precautions. These regulations should be followed.

In some areas, algae and other forms of plant life may become objectionable. They can cause disagreeable tastes or odors, encourage bacterial development, and produce an unsightly appearance.

Pond safety

Ponds, like any body of water, attract people so that there is always a chance of injury or drowning. You may be planning to build a pond for watering livestock, irrigation, or any of the other purposes discussed in this handbook. However, your family and friends may picnic beside the pond or use it for fishing, swimming, boating, or ice skating, and you can never tell what a small child passing by may do.

Your pond can become a source of pleasure as well as profit, but only if it is safe. You can take some of the following steps to prevent injuries or drownings and to protect yourself financially.

Before construction

Almost all states have laws on impounding water and on the design, construction, and operation and maintenance of ponds. In many states small farm ponds are exempt from any such laws. You should become familiar with those that apply in your state and be sure that you and your engineer comply with them.

Find out what your community or state laws are regarding your liability in case of injury or death resulting from use of your pond, whether you authorize such use or not. This is particularly important if you intend to open your pond to the public and charge a fee for its use. You may find that you need to protect yourself with insurance.

You should decide how the water is going to be used so that you can plan the needed safety measures before construction starts. For example, if the water is to be used for swimming, guards over conduits are required. You may wish to provide for beaches and diving facilities; the latter require a minimum depth of about 10 feet of water.

During construction

Your contractor should take other safety measures during pond construction. Remove all undesirable trees, stumps, and brush and all rubbish, wire, junk machinery, and fences that might be hazardous to boating and swimming. Eliminate sudden dropoffs and deep holes.

After completion

Mark safe swimming areas and place warning signs at all danger points. Place lifesaving devices, such as ring buoys, ropes, planks, or long poles, at swimming areas to facilitate rescue operations should the need arise. Place long planks or ladders at ice skating areas for the same reason.

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Glossary

abutment A portion of a valley cross section higher in elevation than the valley floor. The slope above the valley floor.

antiseep collar A constructed barrier installed perpendicular to a pipe or conduit and usually made of the same material as the pipe or conduit. Its purpose is to intercept the flow of seepage along the pipe or conduit and to make the seepage path longer.

appurtenance Interrelated elements or components of a designed system, or structure.

auxiliary spillway The spillway designed to convey excess water through, over, or around a dam.

backslope The downstream slope of an embankment.

bench mark Point of known elevation for a survey. May be in relation to National Geodetic Vertical Datum (NGVD) or assumed for a given project.

berm A strip of earth, usually level, in a dam cross section. It may be located in either the upstream side slope, downstream side slope, or both.

boom A floating barrier extending across a reservoir area, just upstream from the dam, to protect the side slope from erosion.

borrow area An area from which earthfill materials can be taken to construct the dam.

bottom width A flat, level cross section element normally in an open channel, spillway, or trench.

coefficient of permeability The rate of flow of a fluid through a unit cross section of a porous mass under a unit hydraulic gradient.

compaction The process by which the soil grains are rearranged to decrease void space and bring them into closer contact with one another, thereby increasing the weight of solid material per cubic foot.

conduit (pipe) Any channel intended for the conveyance of water, whether open or closed.

control section A part of an open channel spillway where accelerated flow passes through critical depth.

core trench (excavation) of a trench) The trench in the foundation material under an earth embankment or dam in which special material is placed to reduce seepage.

critical depth Depth of flow in a channel at which specific energy is a minimum for a given discharge.

cross section A section formed by a plane cutting an area, usually at right angles to an axis.

dam (earth dam) A constructed barrier, together with any associated spillways and appurtenant works, across a watercourse or natural drainage area, which permanently impounds and stores water, traps sediment, and/or controls flood water.

design elevation The height above a defined datum describing the required elevation of pool that will provide the required temporary storage.

diaphragm See Antiseep collar.

drain An appurtenance installed in the dam and/or its foundation to safely collect and discharge seepage water.

drawings A graphical representation of the planned details of the work of improvements.

drop inlet A vertical entrance joined to a barrel section of a principal spillway system.

earthfill Soil, sand, gravel, or rock construction materials used to build a dam and its components.

effective fill height The difference in elevation in feet between the lowest auxiliary spillway crest and the lowest point in the original cross section on the centerline of the dam. If there is no auxiliary spillway, the top of the dam becomes the upper limit.

embankment A structure of earth, gravel, or similar material raised to form a dam.

excavated pond A reservoir constructed mainly by excavation in flat terrain. A relatively short embankment section on the downstream watercourse side may be necessary for desired storage amount.

exit channel (of an open channel spillway) The portion downstream from the control section that conducts the flow to a point where it may be released without jeopardizing the dam.

fill height The difference in elevation between the existing ground line and the proposed top of dam elevation, including allowance for settlement.

filter and drainage diaphragm A soil piping and water seepage control device installed perpendicular to a pipe or conduit, consisting of a single, or multizones of, aggregate. Its purpose is to intercept the water flow along pipes or conduits and prevent the movement of soil particles that makeup the embankment.

flow depth The depth of water in the auxiliary spillway or any other channel.

foundation The surface upon which a dam is constructed.

freeboard The difference in elevation between the minimum settled elevation of the top of dam and the highest elevation of expected depth of flow through the auxiliary spillway.

hooded or canopy inlet A fabricated assembly attached to the principal spillway pipe to improve the hydraulic efficiency of the overall pipe system.

inlet section (of an open channel spillway) The portion upstream from the control section.

mulch A natural or artificial layer of plant residue or other material, such as grain straw or paper, on the soil surface.

outlet channel A section of open channel downstream from all works of improvement.

outlet section The downstream portion of an open channel or of a principal spillway.

peak discharge The maximum flow rate at which runoff from a drainage area discharges past a specific point.

pond A still body of water of limited size either naturally or artificially confined and usually smaller than a lake.

pool area The location for storing water upstream from the dam.

principal spillway The lowest ungated spillway designed to convey water from the reservoir at predetermined release rates.

profile A representation of an object or structure seen from the side along its length.

propped outlet A structural support to protect the outlet section of a pipe principal spillway.

riprap A loose assemblage of broken stones commonly placed on the earth surface to protect it from the erosive forces of moving water or wave action.

riser The vertical portion of a drop inlet.

sealing The process used to close openings in soil materials and prevent seepage of water.

sediment Solid material, both mineral and organic, that is being transported in suspension, or has been moved from its site of origin by water, air, gravity, or ice and has come to rest on the Earth’s surface either above or below the principal spillway crest.

settlement Movement of an embankment or structure during the application of loads.

side slope (ratio) The ratio of horizontal to vertical distance measured along the slope, either on an open channel bank or on the face of an embankment, usually expressed in “n”:1; e.g., 2:1 (meaning two units horizontal to one unit vertical).

site investigation Site visit to evaluate physical features of a proposed project or watershed including soils data and characteristics of the watershed.

specifications Detailed statements prescribing standards, materials, dimensions, and workmanship for works of improvement.

specific discharge The theorical flow rate through the full flow cross sectional area of a porous media.

spillway An open or closed channel, conduit or drop structure used to convey water from a reservoir. It may contain gates, either manually or automatically controlled, to regulate the discharge of water.

stage The elevation of a water surface above its minimum plane or datum of reference.

storage volume The total volume available from the bottom of the reservoir to the top of dam.

temporary storage The volume from the crest of the principal spillway to the top of dam.

top width The horizontal dimension (planned or existing) across the top of dam, perpendicular to the centerline.

valley floor Part of a valley cross section that is level or gently sloping.

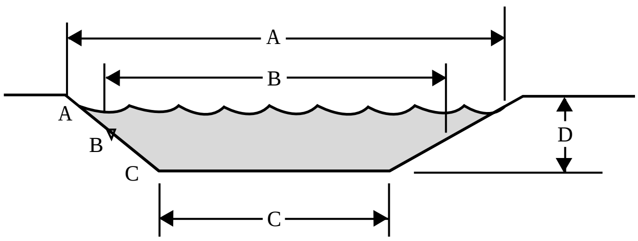
vegetative retardance The amount of hindrance to flow caused by the type, density, and height of vegetation.

visual focus An element in the landscape upon which the eyes automatically focus because of the element's size, form, color, or texture contrast with its surroundings.

Appendix A Estimating the Volume of an Excavated Pond

The volume of a pond can be estimated by using the prismoidal formula:

$$V = \frac{(A + 4B + C)}{6} \times \frac{D}{27}$$



V	=	volume of excavation (yd^3)
A	=	area of excavation at ground level (ft^2)
B	=	area of excavation at the middle depth of the pond (ft^2)
C	=	area of excavation at the bottom of the pond (ft^2)
D	=	average depth of the pond in (ft)
27	=	factor converting cubic feet to cubic yards

Note: When using meters for area and depth, 27 is not needed. The formula would then be:

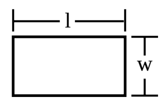
$$V = \frac{(A + 4B + C)}{6} \times D$$

where:

V = volume of excavation (m^3)

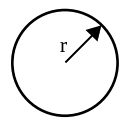
This formula can be used for ponds of any shape. The area of excavation can be determined either by planimetering the shape on the plans or by using geometric formulas for areas. The following formulas give the area of some common shapes.

Rectangle:



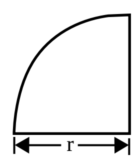
Rectangle $A = wl$

Circle:



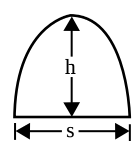
Circle $A = \pi r^2$ or $3.14r^2$

Quadrant:



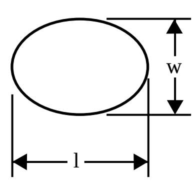
Quadrant $A = \frac{\pi}{4} r\left(r^2 \text{ or } 0.7854r^2\right)$

Parabola:



Parabola $A = 0.67\ sh$

Ellipse:

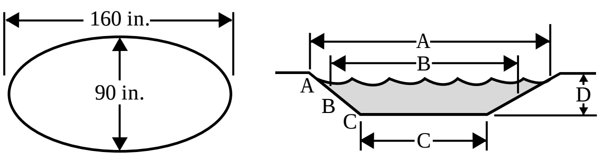


Ellipse $A = \frac{\pi}{4} wl$ or $0.7854\ wl$

Example A–1 Determing the volume of an elliptical pond

As an example, determine the volume of an elliptical pond with a major axis (l) of 160 ft, a minor axis (w) of 90 ft at the surface, a depth (D) of 8 ft, and 2:1 side slopes. Use the prismoidal formula:

$$V = \frac{\left(A + 4B + C\right)}{6} \times \frac{D}{27}$$



Step 1: Calculate the area of the surface (A) using the formula,

$$\text{Area} = \frac{(\pi)}{4} wl \text{ for an ellipse}$$

$$A = \frac{3.14}{4}\left(90 \times 160\right)$$

$$A = 11,304 \ ft^2$$

Step 2: Determine the dimensions of the bottom (C). Since the side slopes are 2:1 and depth is 8 feet, the bottom will be 16 feet narrower than the surface. The bottom dimensions would then be 58 feet (w) by 128 feet (I).

Step 3: Calculate the area of the bottom (C) using

$$C = \frac{3.14}{4}\left(58 \times 128\right)$$

$$C = 5,828 \ ft^2$$

Step 4: Determine the dimensions of the middle depth (B). Since the middle depth lies equally between the surface and the bottom, the dimensions can be determined by adding the surface and bottom dimensions together and dividing by 2.

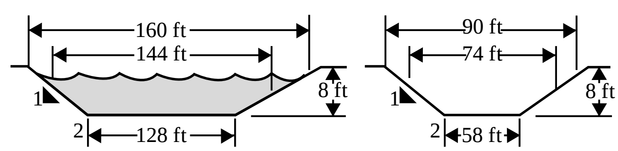
$$\frac{160 + 128}{2} = 144 \text{ (major axis)}$$

$$\frac{90 + 58}{2} = 74 \text{ (minor axis)}$$

Step 5: Calculate the area of the middle depth (B) using Area = (pi) wl.

$$B = \frac{3.14}{4}\left(74 \times 144\right)$$

$$B = 8,365 \ ft^2$$



Step 6: Determine the volume in cubic yards.

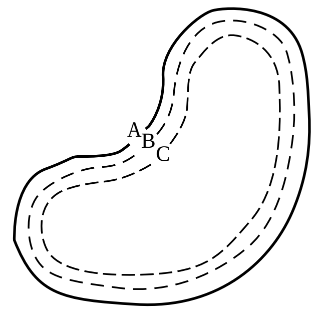
$$V = \frac{\left[11,304 + \left(4 \times 8,365\right) + 5,828\right]}{6} \times \frac{8}{27}$$

$$V = \frac{50,592}{6} \times \frac{8}{27}$$

$$V = 2,498 \text{ or approx. } 2,500 \ yd^3$$

Example A–2 Determining area of the surface, the middle depth, and bottom

The area of the surface, the middle depth, and bottom can also be determined by using a planimeter. In this example, the pond was drawn at a 1 inch = 40 feet scale and has a depth of 8 feet.



Scale: 1 inch = 40 feet

Step 1: Measure the surface area (*A*) using a planimeter. Convert the measurement from square inches into square feet. (A factor of 1,600 is used to convert square inches into square feet for a scale of 1 inch = 40 feet.)

$$A = 10.0\ in^2 \times 1,600 = 16,000\ ft^2$$

Step 2: Measure the middle depth (*B*) area and convert to square feet.

$$B = 7.7\ in^2 \times 1,600 = 12,320\ ft^2$$

Step 3: Measure the bottom (*C*) and convert to square feet.

$$C = 5.5\ in^2 \times 1,600 = 8,800\ ft^2$$

Step 4: Use the prismoidal formula to estimate volume of excavation in cubic yards.

$$V = \frac{(A + 4B + C)}{6} \times \frac{8}{27}$$

$$V = \frac{[16,000 + (4 \times 12,320) + 8,800]}{6} \times \frac{8}{27}$$

$$V = \frac{74,080}{6} \times \frac{8}{27}$$

$$V = 3,658\ yd^3$$

Appendix B Flood-Tolerant Native Trees and Shrubs

Flooding creates several conditions that are unfavorable to most woody species. The most critical condition appears to be the depletion of soil oxygen that is critical to plants. The lack of oxygen favors anaerobic bacteria, which can lead to the development of toxic organic and inorganic byproducts. A plant's ability to survive flooding is dependent on many factors; among them are flood depth, flood duration, flood timing, plant age and size, wave action, and substrata composition.

The plant lists in tables B–1 through B–4 were taken from the Corps of Engineers Technical Report E-79-2, Flood Tolerance of Plants: A State-of-the-Art Review. The ratings used are intended only to be a relative classification. Tolerance will vary with local conditions. The plants are divided into four groups: very tolerant, tolerant, somewhat tolerant, and intolerant. Each plant was also given a range coinciding with the plant growth regions, figure B–1, developed from USDA Miscellaneous Publication 303, Native Woody Plants of the United States, by William R. Van Dersal.

Figure B–1 Plant growth regions

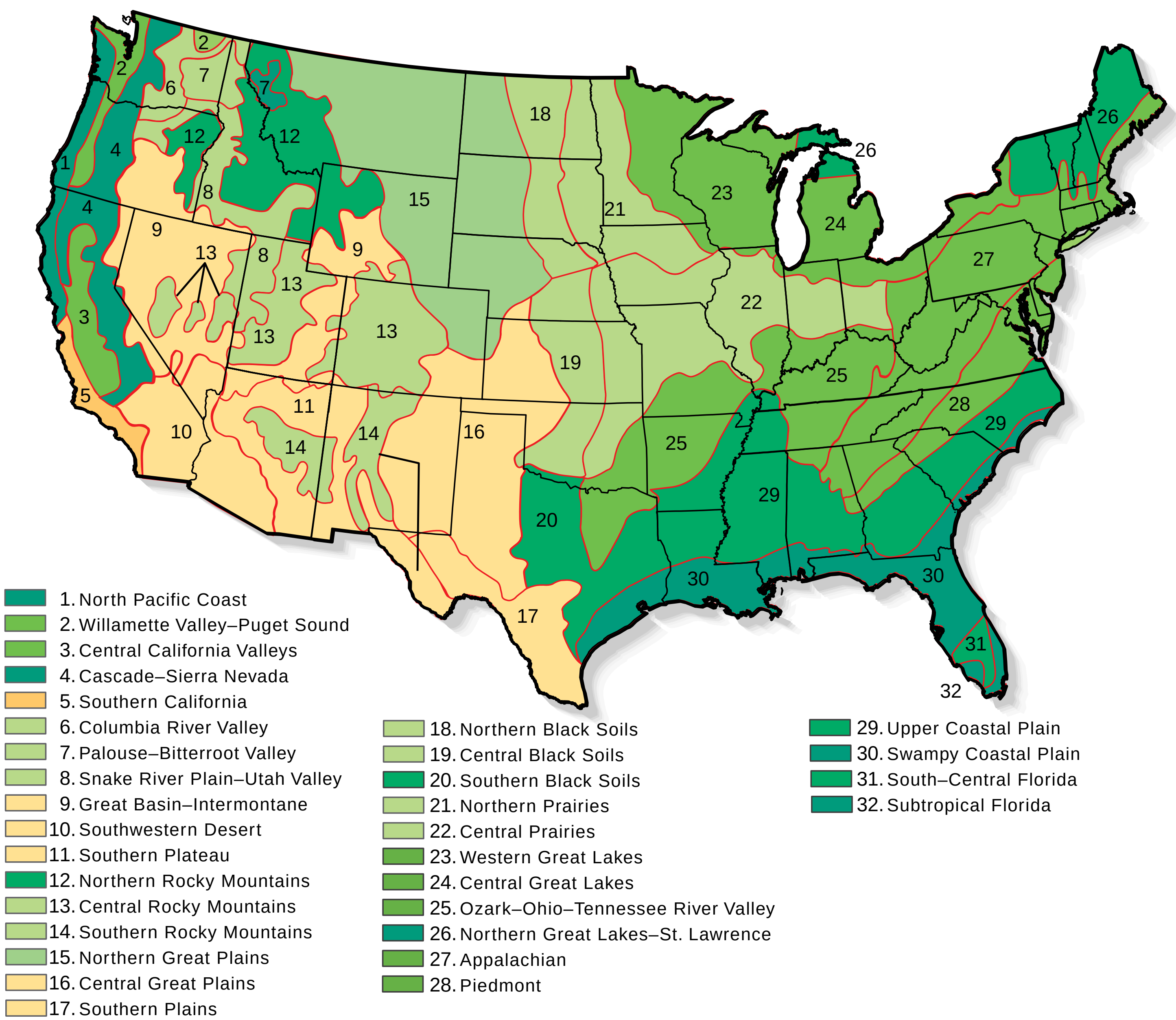


Table B–1 Flood tolerance of **very tolerant** native plants

[These plants are able to survive deep, prolonged flooding for more than 1 year.]

Scientific name	Common name	Range
Carya aquatica	Water hickory	20, 25, 28, 29, 30
C. illinoensis	Pecan	16, 20, 22, 25, 29, 30
Cephalanthus occidentalis	Buttonbush	3-5, 11, 16, 17, 19-30
Cornus stolonifera	Redosier dogwood	4, 7-9, 11-15, 18, 21 -28
Forestiera acuminata	Swamp privet	20, 22, 25, 29, 30
Fraxinus pennsylvanica	Green ash	15, 18, 20-30
Gleditsia aquatica	Waterlocust	20, 25, 28-30
Illex decidua	Deciduous holly	16, 17, 20, 25, 28-30
Nyssa aquatica	Water tupelo	25, 29, 30
Planera aquatica	Water elm	20, 25, 29, 30
Quercus lyrata	Overcup oak	20, 22, 25, 28-30
Salix exigua	Narrow leaf willow	4-16
S. hookeriana	Hooker willow	1
S. lasiandra	Pacific willow	1-5, 11, 13, 14
S. nigra	Black willow	16, 17, 19-30
Taxodium distichum	Baldcypress	17, 20, 25, 28-32

Table B–2 Flood tolerance of **tolerant** native plants

[These plants are able to survive deep flooding for one growing season, with significant mortality occurring if flooding is repeated the following year.]

Scientific name	Common name	Range
Acer negundo	Boxelder	17-30
A. rubrum	Red maple	19-30
A. saccharinum	Silver maple	18-30
Alnus glutinosa	Black alder	26-27
Amorpha fruticosa	False indigo	5, 10, 11, 15-29
Betula nigra	River birch	20, 22, 23, 25-29
Celtis occidentalis	Hackberry	15, 16, 18, 20-30
Diospyros virginiana	Persimmon	20, 22, 25, 27-31
Kalmia polifolia	Bog laurel	4, 12, 23, 24, 26, 27
Ledum groenlandicum	Labrador tea	4, 12, 23, 24, 26, 27
Liquidambar styraciflua	Sweetgum	20, 22, 25, 27-30
Nyssa sylvatica	Blackgum	20, 22, 24-30
Pinus contorta	Lodgepole pine	2, 4, 10, 12-15
Platanus occidentalis	Sycamore	16, 20-22, 24-30
Populus trichocarpa	Black cottonwood	1-8, 12, 13
Quercus lyrata	Overcup oak	20, 22, 25, 28-30
Q. palustris	Pin oak	21-25, 27, 29
Sambucus callicarpa	Pacific red elder	1,2,4
Spirea douglasii	Hardhack	1-4
Tamarix gallica	French tamarisk	3, 4, 9-11, 13, 16, 19, 22, 25, 29, 30
Thuja plicata	Western redcedar	1, 2, 4, 6, 7, 12
Ulmus americana	American elm	15, 16, 18-23, 25-30
Vaccinium uliginosum	Blueberry	1, 4, 12-14, 23, 24, 26, 27

Table B–3 Flood tolerance of **somewhat tolerant** native plants

[These plants are able to survive flooding or saturated soils for 30 consecutive days during the growing season.]

Scientific name	Common name	Range
Alnus rugosa	Hazel alder	20, 22-29
Carpinus caroliniana	Ironwood	20-30
Celtis laevigata	Sugarberry	11, 16, 17, 20, 22, 25, 29, 30
Cornus nuttallii	Pacific dogwood	1-5
Crataegus mollis	Downy hawthorn	
Fraxinum americana	White ash	20, 22-25, 27-30
Gleditsia triacanthos	Honeylocust	16, 20, 22-27, 29, 30
Ilex opaca	American holly	20, 25, 27-30
Juglans nigra	Black walnut	18-30
Juniperus virginiana	Eastern redcedar	18, 20-29
Malus spp.	Apple	
Morus rubra	Red mulberry	16-25, 27-30
Ostrya virginiana	Eastern hophornbeam	15, 18, 20-25, 27-30
Picea stichensis	Sitka spruce	1
Pinus echinata	Shortleaf pine	20, 25, 27-30
P. ponderosa	Ponderosa pine	4
Populus grandidentata	Bigtooth aspen	21-23, 25-28
Quercus alba	White oak	20, 22-30
Q. bicolor	Swamp white oak	21-28
Q. imbricaria	Shingle oak	22-25, 27, 28
Q. macrocarpa	Bur oak	15, 16, 18-30
Q. nigra	Water oak	17, 20, 25, 28-30
Q. phellos	Willow oak	20, 25, 27-30
Q. rubra	Northern red oak	21 -27
Rhus glabra	Smooth sumac	6-9, 11, 14, 15, 17-31
Tilia americana	American basswood	20-27
Tsuga heterophylla	Western hemlock	1 , 2, 4, 6, 12
Ulmus alata	Winged elm	17, 20, 25, 28-30
U. rubra	Red elm	25, 27, 29
Viburnum prunifolium	Blackhaw	20, 22-25, 27-30

Table B–4 Flood tolerance of **intolerant** native plants

[These plants are unable to survive more than a few days of flooding during the growing season without significant mortality.]

Scientific name	Common name	Range
Acer macrophyllum	Bigleaf maple	1-5
A. saccharum	Sugar maple	15, 18, 21-29
Alnus rubra	Red alder	1 , 2, 5, 6
A. sinuata	Sitka alder	2, 4, 6, 7, 12
Betula lutea	Yellow birch	21-28
B. papyrifera	Paper birch	12, 13, 15, 18, 21-24, 26, 27
B. populifolia	White birch	24, 26-28
Buxus sempervirens	Boxwood	
Carya cordiformis	Bitternut hickory	20, 22-30
C. laciniosa	Shellbark hickory	22, 24, 25, 27, 28, 29
C. ovata	Shagbark hickory	21-30
C. tomentosa	Mockernut hickory	20, 22, 24, 25, 27-30
Cercis canadensis	Eastern redbud	22-25, 27-30
Cornus florida	Flowering dogwood	20, 22-25, 27-30
Corylus avellana	Filbert	
C. rostrata	Hazel	15, 18, 21-29
Cotoneaster spp.	Cotoneaster	
Fagus grandifolia	American beech	20, 22-30
Gymnocladus dioica	Kentucky coffeetree	19, 21-25, 27
Ilex aquifolium	Holly	
Philadelphus gordonianus	Mock orange	4, 6-8, 12
Picea abies	Norway spruce	
P. pungens	Colorado spruce	9, 12, 13, 14
P. rubens	Red spruce	27
Pinus strobus	Eastern white pine	21-24, 27
P. taeda	Loblolly pine	19, 20, 22, 25, 28-30
Populus tremuloides	Quaking aspen	1, 2, 4, 6-9, 11, 15, 18, 21-27
Prunus americana	Wild plum	12-25, 27-30
P. emarginata	Bitter cherry	1, 2, 4, 6, 8-14
P. laurocerasus	Cherry-laurel	
P. serotina	Black cherry	11, 18-30
Psuedotsuga menziesii	Douglas fir	
Pyrus rivularis	Wild apple	1, 2, 4
Q. marilandica	Blackjack oak	16,19, 20, 22, 24, 25, 27-30
Q. muehlenbergii	Chinquapin oak	11, 16, 20-30
Q. shumardii	Texas oak	16, 20, 22, 24, 25, 27-29
Q. stellata	Post oak	19, 20, 22, 25, 27-30
Q. velutina	Black oak	20, 22-30
Rhamnus purshinana	Cascara	1-4, 6, 7, 9, 11, 12
Rubus procerus	Blackberry	

Table B–4 Flood tolerance of **intolerant** native plants—Continued.

[These plants are unable to survive more than a few days of flooding during the growing season without significant mortality.]

Scientific name	Common name	Range
Sassafras albidum	Sassafras	20, 22-30
Sorbus aucuparia	Rowan tree	21, 22, 27
Symphoricarpos occidentalis	Snowberry	15, 18, 21-24
Syringa vulgans	Lilac	
Thuja occidentalis	American arborvitae	22-24, 26, 27
Tsuga canadensis	Eastern hemlock	22-25, 27, 28

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

POND

(No.)

CODE 378

DEFINITION

A water impoundment made by constructing an embankment or by excavating a pit or dugout.

In this standard, ponds constructed by the first method are referred to as embankment ponds, and those constructed by the second method are referred to as excavated ponds. Ponds constructed by both the excavation and the embankment methods are classified as embankment ponds if the depth of water impounded against the embankment at the auxiliary spillway elevation is 3 feet or more.

PURPOSE

To provide water for livestock, fish and wildlife, recreation, fire control, develop renewable energy systems, and other related uses, and to maintain or improve water quality.

CONDITIONS WHERE PRACTICE APPLIES

This standard establishes the minimum acceptable quality for the design and construction of low-hazard ponds where:

Failure of the dam will not result in loss of life; damage to homes, commercial or industrial buildings, main highways, or railroads; or in interruption of the use or service of public utilities.

The product of the storage times the effective height of the dam is less than 3,000. Storage is the volume, in acre-feet, in the reservoir below the elevation of the crest of the auxiliary spillway. The effective height of the dam is the difference in elevation, in feet, between the auxiliary spillway crest and the lowest point in the cross section taken along the centerline of the dam. If there is no auxiliary spillway, the top of the dam is the upper limit.

The effective height of the dam is 35 feet or less.

General Criteria Applicable to All Ponds

All federal, State and local requirements shall be addressed in the design.

A protective cover of vegetation shall be established on all exposed areas of embankments, spillways and borrow areas as climatic conditions allow, according to the guidelines in conservation practice standard 342, Critical Area Planting.

Site conditions. Site conditions shall be such that runoff from the design storm can be safely passed through (1) a natural or constructed auxiliary spillway, (2) a combination of a principal spillway and an auxiliary spillway, or (3) a principal spillway.

Drainage area. The drainage area above the pond must be protected against erosion to the extent that expected sedimentation will not shorten the planned effective life of the structure. The drainage area shall be large enough so that surface runoff and groundwater will provide an adequate supply of water for the intended purpose unless an alternate water source exists to serve this purpose. The quality shall be suitable for the water's intended use.

Reservoir area. The topography and geology of the site shall permit storage of water at a depth and volume that will ensure a dependable supply, considering beneficial use, sedimentation, season of use, and evaporation and seepage losses. If surface runoff is the primary source of water for a pond, the soils shall be impervious enough to prevent excessive seepage losses or shall be of a type that sealing is practicable.

Design Criteria for Embankment Ponds

Geological Investigations. Pits, trenches, borings, review of existing data or other suitable means of investigation shall be conducted to characterize materials within the embankment foundation, auxiliary spillway and borrow areas. Soil materials shall be classified using the Unified Soil Classification System.

Foundation cutoff. A cutoff of relatively impervious material shall be provided under the dam if necessary to reduce seepage through the foundation. The cutoff shall be located at or upstream from the centerline of the dam. It shall extend up the abutments as required and be deep enough to extend into a relatively impervious layer or provide for a stable dam when combined with seepage control. The cutoff trench shall have a bottom width adequate to accommodate the equipment used for excavation, backfill, and compaction operations. Side slopes shall not be steeper than one horizontal to one vertical.

Seepage control. Seepage control is to be included if (1) pervious layers are not intercepted by the cutoff, (2) seepage could create swamping downstream, (3) such control is needed to insure a stable embankment, or (4) special problems require drainage for a stable dam. Seepage may be controlled by (1) foundation, abutment, or embankment filters and drains; (2) reservoir blanketing; or (3) a combination of these measures.

Embankment. The minimum top width for a dam is shown in table 1. If the embankment top is to be used as a public road, the minimum width shall be 16 feet for one-way traffic and 26 feet for two-way traffic. Guardrails or other safety measures shall be used where necessary and shall meet the requirements of the responsible road authority. For dams less than 20 feet in height, maintenance considerations or construction equipment limitations may require increased top widths from the minimum shown in Table 1.

Table 1. Minimum top width for dams

Total height of embankment	Top width
feet	*feet*
Less than 10	6
10 – 14.9	8
15 – 19.9	10
20 – 24.9	12
25 – 34.9	14
35 or more	15

Side Slopes. The combined upstream and downstream side slopes of the settled embankments shall not be less than five horizontal to one vertical, and neither slope shall be steeper than two horizontal to one vertical. All slopes must be designed to be stable, even if flatter side slopes are required. Downstream or upstream berms can be used to help achieve stable embankment sections

Slope Protection. If needed to protect the slopes of the dam from erosion, special measures, such as berms, rock riprap, sand-gravel, soil cement, or special vegetation, shall be provided (Technical Releases 56, “A guide for Design and Layout of Vegetative Wave Protection for Earth Dam Embankments” and 69, “Riprap for Slope Protection Against Wave Action” contain design guidance).

Freeboard. The minimum elevation of the top of the settled embankment shall be 1 foot above the water surface in the reservoir with the auxiliary spillway flowing at design depth. The minimum difference in elevation between the crest of the auxiliary spillway and the settled top of the dam shall be 2 feet for all dams having more than a 20-acre drainage area or more than 20 feet in effective height.

Settlement. The design height of the dam shall be increased by the amount needed to insure that after settlement the height of the dam equals or exceeds the design height. This increase shall not be less than 5 percent of the height of the dam, except where detailed soil testing and laboratory analyses or experience in the area show that a lesser amount is adequate.

Principal spillway. A pipe conduit, with needed appurtenances, shall be placed under or through the dam, except where rock, concrete, or other types of lined spillways are used, or where the rate and duration of flow can be safely handled by a vegetated or earth spillway.

For dams with a drainage area of 20 acres or less, the principal spillway crest elevation shall not be less than 0.5 feet below the auxiliary spillway crest elevation. For dams with a drainage area over 20 acres, this difference shall not be less than 1.0 feet.

When design discharge of the principal spillway is considered in calculating peak outflow through the auxiliary spillway, the crest elevation of the inlet shall be such that the design discharge will be generated in the conduit before there is discharge through the auxiliary spillway.

Pipe conduits designed for pressure flow must have adequate anti-vortex devices. The inlets and outlets shall be designed to function satisfactorily for the full range of flow and hydraulic head anticipated.

The capacity of the pipe conduit shall be adequate to discharge long-duration, continuous, or frequent flows without flow through the auxiliary spillways. The diameter of the principal spillway pipe shall not be less than 4 inches. Pipe conduits used solely as a supply pipe through the dam for watering troughs and other appurtenances shall not be less than 1-1/4 inches in diameter.

If the pipe conduit diameter is 10 inches or greater, its design discharge may be considered when calculating the peak outflow rate through the auxiliary spillway.

Pipe conduits shall be ductile iron, welded steel, corrugated steel, corrugated aluminum, reinforced concrete (pre-cast or site-cast), or plastic. Pipe conduits through dams of less than 20 feet total height may also be cast iron or unreinforced concrete.

Pipe conduits shall be designed and installed to withstand all external and internal loads without yielding, buckling, or cracking. Rigid pipe shall be designed for a positive projecting condition. Flexible pipe shall be designed for a maximum deflection of 5 percent. The modulus of elasticity for PVC pipe shall be assumed as one-third of the amount designated by the compound cell classification to account for long-term reduction in modulus of elasticity. Different reductions in modulus may be appropriate for other plastic pipe materials.

The minimum thickness of flexible pipe shall be SDR 26, Schedule 40, Class 100, or 16 gage as appropriate for the particular pipe material. Connections of flexible pipe to rigid pipe or other structures shall be designed to accommodate differential movements and stress concentrations.

All pipe conduits shall be designed and installed to be water tight by means of couplings, gaskets, caulking, waterstops, or welding. Joints shall be designed to remain watertight under all internal and external loading including pipe elongation due to foundation settlement.

Pipe conduits shall have a concrete cradle or bedding if needed to provide improved support for the pipe to reduce or limit structural loading on pipe to allowable levels.

Cantilever outlet sections, if used, shall be designed to withstand the cantilever load. Pipe supports shall be provided when needed. Other suitable devices such as a Saint Anthony Falls stilling basin or an impact basin may be used to provide a safe outlet.

All steel pipe and couplings shall have protective coatings in areas that have traditionally experienced pipe corrosion, or in embankments with saturated soil resistivity less than 4000 ohms-cm or soil pH less than 5. Protective coatings shall be asphalt, polymer over galvanizing, aluminized coating or coal tar enamel as appropriate for the pipe type. Plastic pipe that will be exposed to direct sunlight shall be ultraviolet-resistant and protected with a coating or shielding, or provisions provided for replacement as necessary

Renewable Energy. For detailed criteria where the purpose is to develop renewable energy systems refer to interim conservation practice standard Renewable Energy Production (716).

Cathodic Protection. Cathodic protection is to be provided for coated welded steel and galvanized corrugated metal pipe where soil and resistivity studies indicate that the pipe needs a protective coating, and where the need and importance of the structure warrant additional protection and longevity. If cathodic protection is not provided for in the original design and installation, electrical continuity in the form of joint-bridging straps should be considered on pipes that have protective coatings. Cathodic protection should be added later if monitoring indicates the need.

Seepage Control. Seepage control along a pipe conduit spillway shall be provided if any of the following conditions exist:

- The effective height of dam is greater than 15 feet.
- The conduit is of smooth pipe larger than 8 inches in diameter.
- The conduit is of corrugated pipe larger than 12 inches in diameter.

Seepage along pipes extending through the embankment shall be controlled by use of a drainage diaphragm, unless it is determined that anti-seep collars will adequately serve the purpose.

Drainage Diaphragm. The drainage diaphragm shall function both as a filter for adjacent base soils and a drain for seepage that it intercepts. The drainage diaphragm shall consist of sand meeting the requirements of ASTM C-33, for fine aggregate. If unusual soil conditions exist such that this material may not meet the required filter or capacity requirements, a special design analysis shall be made.

The drainage diaphragm shall be a minimum of 2 feet thick and extend vertically upward and horizontally at least three times the outside pipe diameter, and vertically downward at least 18 inches beneath the conduit invert. The drainage diaphragm shall be located immediately downstream of the cutoff trench, but downstream of the centerline of the dam if the cutoff is upstream of the centerline.

The drainage diaphragm shall be outletted at the embankment downstream toe using a drain backfill envelope continuously along the pipe to where it exits the embankment. Drain fill shall be protected from surface erosion.

Anti-seep Collars. When anti-seep collars are used in lieu of a drainage diaphragm, they shall have a watertight connection to the pipe. Maximum spacing shall be approximately 14 times the minimum projection of the collar measured perpendicular to the pipe but not more than 25 feet. The minimum spacing shall be 10 feet. Collar material shall be compatible with pipe materials. The anti-seep collar(s) shall increase by at least 15 percent the seepage path along the pipe.

Trash Guard. To prevent clogging of the conduit, an appropriate trash guard shall be installed at the inlet or riser unless the watershed does not contain trash or debris that could clog the conduit.

Other Outlets. A pipe with a suitable valve shall be provided to drain the pool area if needed for proper pond management or if required by State law. The principal spillway conduit may be used as a pond drain if it is located where it can perform this function.

Auxiliary spillways. Auxiliary spillways convey large flood flows safely past earth embankments and have historically been referred to as “Emergency Spillways”.

An auxiliary spillway must be provided for each dam, unless the principal spillway is large enough to pass the peak discharge from the routed design hydrograph and the trash that comes to it without overtopping the dam. The following are minimum criteria for acceptable use of a closed conduit principal spillway without an auxiliary spillway: a conduit with a cross-sectional area of 3 ft^2 or more, an inlet that will not clog, and an elbow designed to facilitate the passage of trash.

The minimum capacity of a natural or constructed auxiliary spillway shall be that required to pass the peak flow expected from a design storm of the frequency and duration shown in Table 2, less any reduction creditable to conduit discharge and detention storage.

The auxiliary spillway shall safely pass the peak flow, or the storm runoff shall be routed through the reservoir. The routing shall start either with the water surface at the elevation of the crest of the principal spillway or at the water surface after 10 days’ drawdown, whichever is higher. The 10-day drawdown shall be computed from the crest of the auxiliary spillway or from the elevation that would be attained if the entire design storm were impounded, whichever is lower. Auxiliary spillways shall provide for passing the design flow at a safe velocity to a point downstream where the dam will not be endangered.

Constructed auxiliary spillways are open channels that usually consist of an inlet channel, a control section, and an exit channel. They shall be trapezoidal and shall be located in undisturbed or compacted earth or in-situ rock. The side slopes shall be stable for the material in which the spillway is to be constructed. For dams having an effective height exceeding 20 feet, the auxiliary spillway shall have a bottom width of not less than 10 feet.

Upstream from the control section, the inlet channel shall be level for the distance needed to protect and maintain the crest elevation of the spillway. The inlet channel may be curved to fit existing topography. The grade of the exit channel of a constructed auxiliary spillway shall fall within the range established by discharge requirements and permissible velocities.

Structural auxiliary spillways. If chutes or drops are used for principal spillways or auxiliary spillways, they shall be designed according to the principles set forth in the Part 650, Engineering Field Handbook and the National Engineering Handbook, Section 5, Hydraulics; Section 11, Drop Spillways; and Section 14, Chute Spillways. The minimum capacity of a structural spillway shall be that required to pass the peak flow expected from a design storm of the frequency and duration shown in table 2, less any reduction creditable to conduit discharge and detention storage.

Table 2. Minimum auxiliary spillway capacity

			Minimum design storm[2]	
Drainage area (Ac.)	Effective height of dam[1] (Ft.)	Storage (Ac-Ft)	Frequency (Years)	Minimum duration (Hours)
20 or less	20 or less	< than 50	10	24
20 or less	> than 20	< than 50	25	24
> than 20		< than 50	25	24
All others			50	24

1. As defined under “Conditions where Practice Applies”.

2. Select rain distribution based on climatological region.

Criteria for Excavated Ponds

Runoff. Provisions shall be made for a pipe and auxiliary spillway, if needed, that will meet the capacity requirements of Table 2. Runoff flow patterns shall be considered when locating the excavated pond and placing the spoil.

Side slopes. Side slopes of excavated ponds shall be stable and shall not be steeper than one horizontal to one vertical. If livestock will water directly from the pond, a watering ramp of ample width shall be provided. The ramp shall extend to the anticipated low water elevation at a slope no steeper than three horizontal to one vertical.

Inlet protection. If surface water enters the pond in a natural or excavated channel, the side slope of the pond shall be protected against erosion.

Excavated material. The material excavated from the pond shall be placed so that its weight will not endanger the stability of the pond side slopes and it will not be washed back into the pond by rainfall. It shall be disposed of in one of the following ways:

Uniformly spread to a height that does not exceed 3 feet, with the top graded to a continuous slope away from the pond.

Uniformly placed or shaped reasonably well, with side slopes assuming a natural angle of repose. The excavated material will be placed at a distance equal to the depth of the pond but not less than 12 feet from the edge of the pond.

Shaped to a designed form that blends visually with the landscape.

Used for low embankment construction and leveling of surrounding landscape.

Hauled away.

CONSIDERATIONS

Visual resource design. The visual design of ponds should be carefully considered in areas of high public visibility and those associated with recreation. The underlying criterion for all visual design is appropriateness. The shape and form of ponds, excavated material, and plantings are to relate visually to their surroundings and to their function.

The embankment may be shaped to blend with the natural topography. The edge of the pond may be shaped so that it is generally curvilinear rather than rectangular. Excavated material can be shaped so that the final form is smooth, flowing, and fitting to the adjacent landscape rather than angular geometric mounds. If feasible, islands may be added for visual interest and to attract wildlife.

Cultural Resources. Consider existence of cultural resources in the project area and any project impacts on such resources. Consider conservation and stabilization of archeological, historic, structural, and traditional cultural properties when appropriate.

Fish and Wildlife. Project location and construction should minimize the impacts to existing fish and wildlife habitat.

When feasible, structure should be retained, such as trees in the upper reaches of the pond and stumps in the pool area. Upper reaches of the pond can be shaped to provide shallow areas and wetland habitat.

If fish are to be stocked, consider criteria and guidance in conservation practice standard 399, Fishpond Management.

Vegetation. Stockpiling topsoil for placement on disturbed areas can facilitate revegetation.

Consider placement and selection of vegetation to improve fish and wildlife habitat and species diversity.

Water Quantity. Consider effects upon components of the water budget, especially:

- Effects on volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation, and ground water recharge.
- Variability of effects caused by seasonal or climatic changes.
- Effects on downstream flows and impacts to environment such as wetlands, aquifers, and; social and economic impacts to downstream uses or users.
- Potential for multiple purposes.

Water Quality

- Consider effects on erosion and the movement of sediment, pathogens, and soluble and sediment-attached substances that are carried by runoff.
- Effects on the visual quality of onsite and downstream water resources.
- Short-term and construction-related effects of this practice on the quality of downstream water courses.
- Effects of water level control on the temperatures of downstream water to prevent undesired effects on aquatic and wildlife communities.
- Effects on wetlands and water-related wildlife habitats.
- Effects of water levels on soil nutrient processes such as plant nitrogen use or denitrification.
- Effects of soil water level control on the salinity of soils, soil water, or downstream water.
- Potential for earth moving to uncover or redistribute toxic materials such as saline soils.

PLANS AND SPECIFICATIONS

Plans and specifications for installing ponds shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

OPERATION AND MAINTENANCE

An operation and maintenance plan shall be developed and reviewed with the landowner or individual responsible for operation and maintenance.

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

IRRIGATION RESERVOIR

(Ac.-Ft.)

CODE 436

DEFINITION

An irrigation water storage structure made by constructing a dam, embankment, pit, or tank.

PURPOSE

This practice may be applied as part of a resource management system to achieve one or more of the following purposes:

- Store water to provide a reliable irrigation water supply or regulate available irrigation flows.
- Improve Water Use Efficiency on irrigated land.
- Provide storage for tailwater recovery and reuse.
- Provide irrigation runoff retention time to increase breakdown of chemical contaminants.
- Reduce energy use.
- Develop renewable energy systems (i.e., hydropower).

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to irrigation water storage structures that meet one or more of the following criteria:

- The existing available water supply is insufficient to meet irrigation requirements during all or part of the irrigation season.
- Water is available for storage from surface runoff, stream flow, irrigation canals, or a subsurface source.
- A suitable site is available for construction of a storage reservoir.

This practice applies to planning and functional design of storage capacity, and inflow/outflow capacity requirements for irrigation storage reservoirs. Storage reservoirs shall be planned and located to serve as an integral part of an irrigation system.

This practice applies to reservoirs created by embankment structures or excavated pits to store diverted surface water, groundwater, or irrigation system tailwater for later use, or reuse.

The practice also applies to reservoirs created by embankment structures or excavated pits and tanks constructed of concrete, steel, or other suitable materials used to collect and regulate available irrigation water supplies to accomplish the intended purpose.

CRITERIA

General Criteria Applicable to All Purposes

Structure type selection (excavated pit, embankment, or tank) shall be based on a site specific assessment involving hydrologic studies, engineering and geologic investigations, available construction materials, and natural storage.

Storage Capacity. Design capacity computations shall be based on planned inflow volumes and rates over the storage period, and outflow volumes and rates required to meet planned irrigation system needs.

Structure storage capacity must provide sufficient volume to meet variations in water demand within the irrigation period.

Compute demand flow rates based on the consumptive use-time relationship using anticipated irrigation efficiencies, conveyance losses, and other uses such as leaching, frost control, seepage, and evaporation.

Irrigation storage reservoirs planned primarily to regulate irrigation flows shall have adequate

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact your Natural Resources Conservation Service State Office or visit the Field Office Technical Guide.

capacity to provide design irrigation application flow rates.

Structure capacity shall provide adequate storage for inflow while maintaining sufficient water levels to insure proper operation of outlet works and provide uniform outflow rate during planned irrigation events.

Provide additional capacity as needed for sediment storage.

Foundation, Embankment, and Spillways. Earthen dams, embankments, pits, associated spillways, and appurtenant structures shall be designed to meet criteria in the applicable NRCS Conservation Practice Standards, Pond (378), or Dam (402).

Seepage. Prevent excessive seepage losses by use of an appropriate method of sealing or lining.

Overflow Protection. Overflow protection shall be provided if overflow of the irrigation storage reservoir is possible.

Inlet and Outlet Works. Design conduit and open spillways according to guidelines in appropriate chapters of the NRCS National Engineering Handbook.

Provide inlet works when needed to prevent erosion or control flows into the irrigation storage reservoir. Inlet works may consist of a direct pumping system, conduit, grassed channel, lined channel, chute, head gates, valves, or other appurtenances necessary to safely convey and control water entering the structure.

Outlet works shall be provided for controlled withdrawal, transfer, or release of irrigation water. Outlet works may consist of a direct pumping system or a conduit from the storage reservoir to an area of use. The capacity of the outlet works shall be adequate to provide the outflow rate needed to meet irrigation system demands.

Design and install specialized inlet or outlet works when needed to avoid entraining or impinging aquatic organisms.

Additional Criteria Applicable to Storage for Tailwater Recovery and Reuse

Capacity. When energy sources for tailwater pump back systems are subject to interruption and

- safe emergency bypass areas cannot be provided, or
- tailwater discharges violate local or state regulations,

Tailwater storage requirements shall, as a minimum, include a volume adequate to store all tailwater runoff from a single irrigation set.

Additional Criteria Applicable to Irrigation Runoff Retention Time to Increase Breakdown of Chemical Contaminants

Capacity. Where additional storage or flow regulation are required to provide adequate retention time for breakdown of chemicals in runoff waters, storage facilities shall be sized accordingly. Allowable retention times shall be site specific to the particular chemical of concern.

Additional Criteria Applicable to Reduce Energy Use

Provide analysis to demonstrate reduction of energy use from practice implementation.

Reduction of energy use is calculated as average annual or seasonal energy reduction compared to previous operating conditions.

Additional Criteria Applicable to Develop Renewable Energy Systems

Renewable energy systems shall meet applicable design criteria in NRCS and/or industry standards, and shall be in accordance with manufacturer's recommendations. Hydropower systems shall be designed, operated, and maintained in accordance with the Microhydropower Handbook, Sections 4 and 5, as appropriate.

CONSIDERATIONS

When planning this practice, the following items should be considered where applicable:

- Potential energy savings resulting from regulation of irrigation flows, tailwater reuse, improved pumping plant efficiency, or management changes.
- Planting of critical areas at the completion of construction to protect the structure and borrow areas, and prevent erosion.
- Effects of soil physical and chemical properties, as well as potential soil limitations, relating to embankment

construction, compaction, stability, bearing strength, pool area seepage, and soil corrosivity. Refer to soil survey data as a preliminary planning tool for assessment of pool and borrow areas, and conduct

- On-site soil investigations during the final planning stage.
- Perimeter fences to prevent human and animal access, and emergency escape facilities to minimize human safety hazards.
- Construction-related effects on air quality and on water quality of downstream water courses.
- Potential for earth moving construction to uncover or redistribute toxic materials or on-site invasive species.
- Development of water budgets, to quantify sources of inflow (precipitation and withdrawals), and outflow (evapotranspiration and losses).
- Impacts on downstream flows or aquifers that could affect other water uses or users.
- Impacts on the quantity of downstream flows, which could have undesirable environmental, social, or economic effects.
- Impacts of erosion, sediment, soluble contaminants, seeds or vegetative materials of invasive species, and contaminants attached to sediment in runoff.
- The movement of dissolved substances to ground water.
- Effects of water temperature changes on aquatic and wildlife communities.
- Timing of vegetation-disturbing maintenance activities, to avoid grassland bird nesting seasons.
- Impacts on wetlands or water-related wildlife habitats.
- Impacts on the visual quality of water resources and the landscape.
- Impacts on cultural resources.
- Performing periodic water quality analysis to evaluate salinity, nutrients, pesticides, and pathogens.
- Opportunities to include variety in vegetation for embankment stabilization or revegetation maintenance, that would provide pollinator forage from early spring to late fall.

PLANS AND SPECIFICATIONS

Plans and specifications for constructing irrigation storage reservoirs shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purposes.

Plans and specifications for constructing earthen irrigation storage reservoirs shall be based on criteria found in NRCS Conservation Practice Standards, Pond (378), or Dam (402).

Plans and specifications for tanks constructed of non earthen materials shall be based on construction and materials specifications for NRCS Conservation Practice Standard, Watering Facility (614).

OPERATION AND MAINTENANCE

An Operation and Maintenance plan shall be prepared for landowner or operator use. The plan shall provide specific instructions for operating and maintaining facilities to ensure they function properly. The plan shall include the following provisions:

- Periodic cleaning and regrading of water storage facilities to maintain functionality.
- Periodic inspection, removal of debris, and repair if needed of trash racks and inlet and outlet structures to assure proper operation.
- Routine maintenance of mechanical components in accordance with manufacturer recommendations.
- Periodic inspection and maintenance of embankments and earth spillways to repair damage or control erosion and undesirable vegetation.
- Periodic removal of sediment from traps or storage facilities to maintain design capacity and efficiency.
- Periodic Inspection or testing of all pipelines and pumping plant components and appurtenances, as applicable.

REFERENCES

McKinney, J.D., et al. Microhydropower Handbook, IDO-10107, Volumes 1 & 2. U.S. Department of Energy, Idaho Operations Office.

Exhibit 14

Riparian Areas Environmental Uniqueness, Functions, and Values

RCA Issue Brief #11 August 1996

Did you know ...

...that the flow of water through riparian soils regenerates ground water?

...that riparian vegetation can remove excess nutrients and sediment from surface runoff and shallow ground water? And that riparian vegetation shades streams to optimize light and temperature conditions for aquatic plants, fish, and other animals?

...that riparian areas provide important habitat for many endangered and threatened species and other wildlife and plants?

...that the appearance and boundary of riparian areas vary from site to site?

...that some riparian areas function and meet criteria established for wetlands?

...that the character of a riparian area is dependent upon the condition of the watershed in which it is located?

...that although riparian ecosystems generally occupy small areas on the landscape, they are usually more diverse and have more plants and animals than adjacent upland areas?

What are riparian areas?

Riparian areas are lands that occur along watercourses and water bodies. Typical examples include flood plains and streambanks. They are distinctly different from surrounding lands because of unique soil and vegetation characteristics that are strongly influenced by the presence of water.

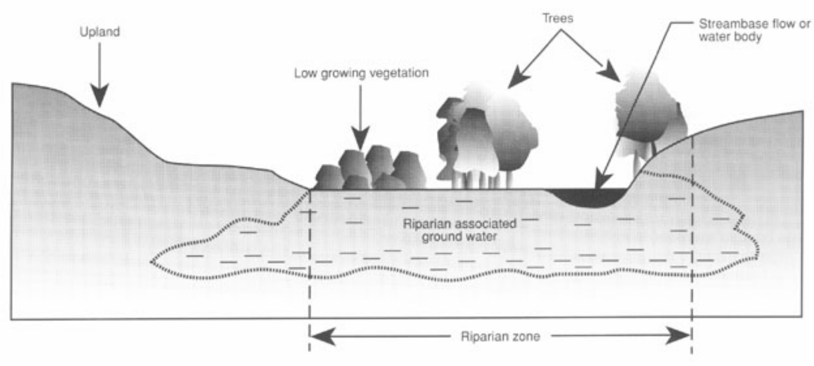
General indicators of riparian areas include:

- **Vegetation**
  The kinds and amounts of vegetation differ from adjacent upland vegetation because more water is supplied to plants from the associated watercourse or water body.
- **Soil**
  Soil in natural riparian areas consists of stratified sediments of varying textures that are subject to intermittent flooding or fluctuating water tables that may reach the surface. The duration of soil wetness depends on the water levels of the adjacent water body.
- **Water**

Riparian areas are directly influenced by water from a watercourse or water body. They occur along natural watercourses or next to natural lakes and constructed water bodies such as ditches, canals, ponds, and reservoirs.

In the western United States, riparian areas comprise less than 1 percent of the land area, but they are among the most productive and valuable natural resources. There is a significant difference between the water-rich riparian areas and the arid uplands. Riparian areas are the major providers of habitat for endangered and threatened species in the western desert areas. In the humid east, the riparian areas are more similar to the uplands. In many areas, the separation of the riparian zone from the upland is not distinct.

Major components of a stream or water body riparian area—Riparian areas can be symmetrical or asymmetrical in shape. The topography and hydrogeology determine the plant and animal communities associated with the width or meandering riparian area configurations.



Values and functions of riparian areas

Because of their variation across the country, riparian areas function in different ways. In spite of their differences, all riparian areas possess some similar ecological characteristics such as energy flow, nutrient cycling, water cycling, hydrologic function, and plant and animal population. These functions give riparian areas unique values relative to the surrounding landscape. Some of the more recognizable functions and values of riparian areas are:

Hydrology

Water flow that shaped the riparian zone affects soil development and growth of vegetation.

- Because riparian zones occupy low areas in the landscape, ground water is generally nearer to the surface and available for plants. The fine-textured sediments in flood plains are also able to hold large amounts of water. These two conditions promote productive and diverse plant communities.
- Nutrients for plant growth in riparian ecosystems depend on sedimentation of nutrient-rich organic matter and on the dissolved nutrients in the water. Riparian zones are often nutrient-rich ecosystems.
- Because flooding occurs periodically, and ground water moves through flood plain soils, the surface layers of soils are wetted and dried seasonally. The presence and movement of the surface and ground water enhance the recycling of nutrients and other chemical reactions beneficial to plant growth within the riparian zone.

The timing of flooding is important to the life cycle of many aquatics and some terrestrial species. A naturally occurring flood pulse enhances survivability of organisms within the riparian zone and promotes species diversity and biological productivity.

Base flow

Alluvial soil, which is sedimentary material deposited by flowing water, is usually deep and stores large amounts of water from rainfall and runoff. Many alluvial aquifers in the western United States are maintained by infiltration of upland runoff in the stream channel or riparian alluvial deposits. Base flow--that portion of water flowing in a stream that is due to ground water seepage into the channel--is further maintained by riparian vegetation that shades the water, keeping it cooler and slowing evaporation.

Nutrient cycling

Once nutrients enter a riparian area, they are exposed to mechanisms that may use or change them. Some nutrients, especially nitrogen, phosphorus, calcium, magnesium, and potassium, are taken up by shallow-rooted riparian vegetation. Dissolved nutrients moving with the ground water and those that are leached in the soil may be taken up by deeper-rooted riparian vegetation. Some nutrients pass through without being detained, and some that are taken up by riparian vegetation may be reintroduced into the water column when the vegetation dies and decomposes.

Energy transfer

The uniqueness of riparian areas derives from the fact that litter-fall produced within the riparian ecosystem may be transported laterally and made available to in-stream animal communities as well as those downstream from the source of organic matter production. As compared with purely aquatic or terrestrial ecosystems, riparian organic matter has the potential of supporting a diversity of food webs within both habitats.

Downstream flooding

Riparian area vegetation is a key factor in reducing downstream flooding. As floodwater flows through a vegetated area, the plants resist the flow and dissipate the energy, increasing the time available for water to inflitrate into the soil and be stored for use by plants.

Water quality

As floodwater spreads over a flood plain, water velocities are reduced, making it less likely for sediment and nutrient-rich organic materials to reenter the stream. Sediment and nutrients carried by overland flow from adjacent uplands are also intercepted by the riparian area.

Aquatic life

Rooting herbaceous and woody vegetation helps shape aquatic habitat and stabilizes streambanks, retards erosion, and, in places, creates overhanging banks that serve as habitat for fish. Trapping sediment before it reaches the stream helps maintain a cleaner or more sediment-free stream bottom where aquatic organisms live. These organisms are important sources of food for fish and birds.

Terrestrial life

Riparian ecosystems are extremely productive and have diverse habitat values for wildlife. This is demonstrated most visibly in the western United States, where riparian habitat comprises less than 1 percent of the total land area at some time of the year but supports most of the terrestrial wildlife. The linear nature of riparian ecosystems provides distinct corridors that are important as migration and dispersal routes and as forested connectors between habitats for wildlife.

Some riparian areas meet the criteria established for wetlands. The functions of wetland and riparian areas generally depend on configuration, soils, vegetation, hydrology, and landscape context. Even nonwetland riparian areas share many characteristics, functions, and values with wetlands; such as surface or ground water, or both, and several varieties of plant and animal communities.

Disturbances to riparian areas

Flooding the the resulting erosion and deposition are common forces that shape the riparian area. During extreme flooding, these forces can sometimes appear devastating, but in most cases, the riparian area recovers rapidly. On the other hand, changes made by people often have long-term adverse effects on riparian areas. Building dams across channels, constructing levees, and the channelization of the streams may have the most adverse impact. These modifications significantly alter the movement and storage of water that is so important to the riparian system. Water withdrawals from streams also may reduce base flow, depriving riparian areas of moisture.

People's most common disturbance to riparian areas involves clearing vegetation and converting the area to other uses such as cropland and urban land. Excessive logging can strip the banks of vegetation. Overgrazing concentrates livestock in riparian areas for extended periods, reduces the vegetation, and tramples streambanks. Recreational development can destroy natural plant diversity and structure, lead to soil compaction and erosion, and disturb wildlife. Exotic plants that take advantage of the good growing conditions found in riparian zones often invade these areas. As these plants dominate native plants, the overall vegetative diversity decreases, resulting in less favorable habitat for most wildlife species.

The character of a riparian area is dependent upon he condition of its watershed. Most important is the relationship of watershed hydrology to the riparian area. In general, the amounts and type of vegetative ground cover, the area of the watershed, and the slope of the terrain are directly related to the percentage of water that will enter the drainage system as surface flow or as percolated water. Riparian plant composition, habitat structure, and productivity are determined by the timing, duration, and extent of flooding. Land use changes, paved-over areas, or the removal of vegetation cause water to flow quickly from a watershed and through a riparian zone. Soil moisture storage and productivity are reduced. This can lead to prolonged periods of no flow or low flow and increase frequency and duration of flooding, resulting in a drastic decline in productivity.

Multiple benefits

- Riparian areas help control nonpoint source pollution by holding and using nutrients and reducing sediment.
- Riparian areas are often important for the recreation and scenic values. However, because riparian areas are relatively small and occur in conjunction with watercourses, they are vulnerable to severe alteration and damages caused by people.
- Riparian areas supply food, cover, and water for a large diversity of animals and serve as migration routes and stopping points between habitats for a variety of wildlife.
- Trees and grasses in riparian areas stabilize streambanks and reduce floodwater velocity, resulting in reduced downstream flood peaks.
- Alluvial aquifers help maintain the base flow in many rivers in humid areas because of high water tables. In drier climates, streams lose water that can help build up the water table deep beneath the stream.

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Stream Restoration

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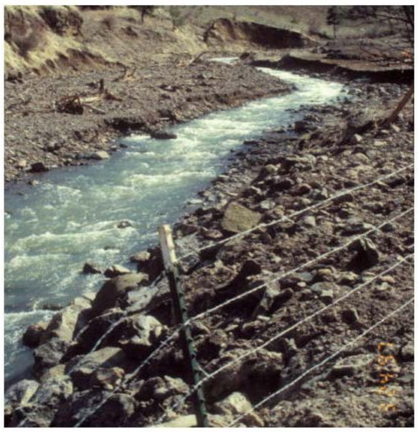
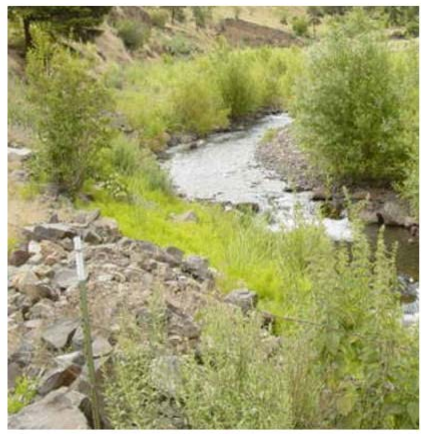

Stream Restoration information

Stream Corridor Restoration (National Engineering Handbook 653)

Stream Restoration Design (National Engineering Handbook 654)

NRCS Stream Corridor Restoration Team Workgroup

These files require **Adobe Acrobat**.

Channel Restoration Design for Meandering Rivers (8 Mb, Corps of Engineers)
Hydraulic Design of Stream Restoration Projects (10.5 Mb, Corps of Engineers)
Design of Spur-Type Streambank Stabilization Structures (10.5 Mb, FHWA)

Assessing Conditions of Riparian-Wetland Corridors at the Areawide Leve
Using Proper Functioning Condition (PFC) methodology — an interdisciplinary assessment tool (Technical Report, September 1999)

Assessing Conditions of Riparian-Wetland Corridors (881 KB)

Engineered Log Jams

"We Be Jammin'" Article, Wildlife Conservation, Mar/Apr 1999 (1.4 MB)
"Jammin' for the Salmon" Article, San Jose Mercury News, April 1999 (19.5 KB)

Let Rivers Teach Us
A paper presented by Luna Leopold

Let Rivers Teach Us (11 KB)

A Reflection on the Johnson Creek Watershed Water Quality Improvemen Project

1982-1999 (Draft Document)

A Reflection on the Johnson Creek Watershed Water Quality Improvement Project (10.1 MB)

The Restoration & Management of Small Wetlands of the Mountains & Piedmont in the Southeast
A Manual Emphasizing Endangered & Threatened Species Habitat with a Focus on Bog Turtles

Preface (277 KB)
Chapter 1: Introduction (420 KB)
Chapter 2: Ecology of Bog Turtles (286 KB)
Chapter 3: Identifying Important Small Wetlands and Potential Sites for Rare Species in the Southeast (205 KB)
Chapter 4: Planning for Success (631 KB)
Chapter 5: Managing Wetland Vegetation (584 KB)
Chapter 6: Managing Hydrology (613 KB)
Chapter 7: Programs and Permitting (151 KB)
Appendix A: Reference Wetland Plant Communities (98 KB)
Appendix B: Rare Animals and Plants of Southern Appalachian Wetlands (85 KB)
Appendix C: Example Handout on Endangered Species (75 KB)
Appendix D: Directory of Contacts for Rare Species (75 KB)
Appendix E: Wetland Site Data Sheet (90 KB)
Appendix F: Informative Handouts for Landowners (34 KB)
Appendix G: Additional Herbicide Information (15 KB)
Glossary (18 KB)
Biographies of the Authors (10 KB)

Riparian Forest Buffers

Introduction (880 KB)
Design Exercise (482 KB)
Model State Standard, January 2001 (364 KB)
Model State General Specifications, January 2001 (149 KB)
Conservation Practice Job Sheet, April 1997 (132 KB)

STREAM*A*SYST - Stream Corridor Inventory and Assessment Techniques
A guide to site, project and landscape approaches suitable for local conservation programs (Technical Report, January 2001, revised)

STREAM*A*SYST (879 KB)

Stream Corridor Inventory and Assessment Techniques
A guide to site, project and landscape approaches suitable for local conservation programs (Technical Report, January 2001, revised)

Stream Corridor Inventory and Assessment Techniques (2.55 MB)

Sugar Creek Watershed Project
An Application of Geomorphic Principles to Sands and Low Plasticity Silts

Case Study, July 1998 (143 KB)
Appendix 1a: Hierarchical River Inventory Levels (15 KB)
Appendix 1b: Major Stream Type Delineative Criteria (347 KB)
Appendix 1c: Natural River Classification Key (457 KB)

Watershed Condition Series

Biotic Condition Indicators for Water Resources (1.8 MB)
Index of Biotic Integrity (IBI) (921 KB)
The EPT Index (905 KB)

Last Modified: 03/14/2012

RIPARIAN FOREST BUFFER

PRACTICE INTRODUCTION

USDA, Natural Resources Conservation Service - practice code 391

RIPARIAN FOREST BUFFER

A riparian forest buffer is an area of trees and/or shrubs located adjacent to a body of water. The vegetation extends outward from the water body for a specified distance necessary to provide a minimum level of protection and/or enhancement.

PRACTICE INFORMATION

This practice applies to areas adjacent to permanent or intermittent streams, lakes, ponds, wetlands and areas associated with ground water recharge.

The riparian forest buffer is a multi-purpose practice design to accomplish one or more of the following:

1. Create shade to lower water temperatures and improve habitat for aquatic animals.
2. Provide a source of debris necessary for healthy robust populations of aquatic organisms and wildlife.
3. Act as a buffer to filter out sediment, organic material, fertilizer, pesticides and other pollutants that may adversely impact the water body, including shallow ground water.

Dominant vegetation consists of existing or planted trees and shrubs suited to the site and purpose (s) of the practice. Grasses and forbs that come in naturally further enhance the wildlife habitat and filtering effect of the practice.

Headcuts and streambank erosion should be assessed and treated appropriately before establishing the riparian forest buffer.

Specifications for each installation are based on a thorough field investigation of each site.

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

RIPARIAN FOREST BUFFER

(Ac.)

CODE 391

DEFINITION

An area predominantly trees and/or shrubs located adjacent to and up-gradient from watercourses or water bodies.

PURPOSE

- Create shade to lower or maintain water temperatures to improve habitat for aquatic organisms.
- Create or improve riparian habitat and provide a source of detritus and large woody debris.
- Reduce excess amounts of sediment, organic material, nutrients and pesticides in surface runoff and reduce excess nutrients and other chemicals in shallow ground water flow.
- Reduce pesticide drift entering the water body.
- Restore riparian plant communities.
- Increase carbon storage in plant biomass and soils.

CONDITIONS WHERE PRACTICE APPLIES

Riparian forest buffers are applied on areas adjacent to permanent or intermittent streams, lakes, ponds, and wetlands. They are not applied to stabilize stream banks or shorelines.

CRITERIA

General Criteria Applicable to All Purposes

The riparian forest buffer shall be positioned appropriately and designed to achieve sufficient width, length, vertical structure/density and connectivity to accomplish the intended purpose(s).

Dominant vegetation will consist of existing, naturally regenerated, or seeded/planted trees and shrubs suited to the soil and hydrology of the site and the intended purpose(s).

The vegetation will extend a minimum width to achieve the purpose(s). Measurement shall begin at and perpendicular to the normal water line, bank-full elevation, or the top of the bank as determined locally.

Overland flow through the riparian area will be maintained as sheet flow.

For sites to be regenerated or planted, excessive sheet-rill and concentrated-flow erosion will be controlled.

Excessive sheet-rill and concentrated-flow erosion will be controlled in the areas immediately adjacent and up-gradient of the buffer site.

Use tree and shrub species that are native and non-invasive. Substitution with improved and locally accepted cultivars or purpose-specific species is allowed. For plantings and seeding, only viable, high-quality and adapted plant materials will be used.

Favor tree and shrub species that have multiple values such as those suited for timber, nuts, fruit, florals, browse, nesting, and aesthetics.

Periodic removal of some forest products such as high value trees, medicinal herbs, nuts, and fruits is permitted provided the intended purpose is not compromised by the loss of vegetation or harvesting disturbance.

Necessary site preparation and planting shall be done at a time and manner to insure

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact your Natural Resources Conservation Service State Office or visit the Field Office Technical Guide.

survival and growth of selected species for achieving the intended purpose(s).

Livestock shall be controlled or excluded as necessary to achieve the intended purpose. Refer to the standards Prescribed Grazing, 528, and/or Access Control, 472, as applicable.

Harmful plant and animal pests present on the site will be controlled or eliminated as necessary to achieve and maintain the intended purpose. If pesticides are used, refer to the standard Pest Management, 595.

Additional Criteria to Reduce Excess Amounts of Sediment, Organic Material, Nutrients and Pesticides in Surface Runoff and Reduce Excess Nutrients and Other Chemicals in Shallow Ground Water Flow

The minimum width shall be at least 35 feet measured horizontally on a line perpendicular to the water body beginning at the normal water line, bank-full elevation, or the top of the bank as determined locally.

The width will be extended in high nutrient, sediment, and animal waste application areas, where the contributing area is not adequately treated or where an additional level of protection is needed.

Existing, functional underground drains through the riparian area will pass pollutants directly to the outlet. To filter such pollutants, drains can be plugged, removed or replaced with perforated pipe/end plugs or water control structures (see Structure for Water Control - 587) to allow passage and filtration of drain water through the riparian forest root zone. Caution is advised that saturated conditions in the riparian and adjacent areas may limit existing land use and management.

Additional Criteria to Create or Improve Riparian Habitat and Provide a Source of Detritus and Large Woody Debris.

The width will be extended to meet the minimum habitat requirements of the wildlife or aquatic species of concern.

Establish plant communities that address the target aquatic and terrestrial wildlife and pollinator needs and have multiple values such as habitat, nutrient uptake and shading. The establishment of diverse native woody and herbaceous species will enhance wildlife and pollinator values.

Additional Criteria for Increasing Carbon Storage in Biomass and Soils

Maximize width and length of the riparian forest buffer.

Select plants that have higher rates of carbon sequestration in soils and plant biomass and are adapted to the site to assure strong health and vigor. Plant the appropriate stocking rate for the site.

CONSIDERATIONS

Tree and shrub species, which may be alternate hosts to undesirable pests, should be avoided. Species diversity should be considered to avoid loss of function due to species-specific pests.

Using seed and/or seedlings collected or propagated from multiple sources can increase genetic diversity.

Consider selecting species with tolerance to herbicide leakage from adjoining fields.

Allelopathic impacts of plants should be considered.

The location, layout and density of the buffer should complement natural features, and mimic natural riparian forests.

For sites where continued function of drains is desired, woody root penetration may eventually plug the underground structure. In these cases, a setback of woody vegetation planted over the drain maintained in herbaceous cover or using rigid, non-perforated pipe will minimize woody root penetration.

Maximize widths, lengths, and connectivity of riparian forest buffers.

The species and plant communities that attain biomass more quickly will sequester carbon/ faster. The rate of carbon sequestration is enhanced as riparian plants mature and soil organic matter increases.

PLANS AND SPECIFICATIONS

Specifications for applying this practice shall be prepared for each site and recorded using approved specification sheets, job sheets, technical notes, and narrative statements in the conservation plan, or other acceptable documentation.

OPERATION AND MAINTENANCE

The riparian forest buffer will be inspected periodically and protected from adverse impacts such as excessive vehicular and pedestrian traffic, pest infestations, concentrated flows, pesticides, livestock or wildlife damage and fire.

Replacement of dead trees or shrubs and control of undesirable vegetative competition will be continued until the buffer is, or will progress to, a fully functional condition.

Any manipulation of species composition, stand structure and stocking by cutting or killing selected trees and understory vegetation shall sustain the intended purpose(s). Refer to the standard Forest Stand Improvement, 666.

Control or exclusion of livestock and harmful wildlife shall continue. Refer to the standards Prescribed Grazing, 528, and/or Access Control, 472, as applicable.

Fertilizers, pesticides and other chemicals used to maintain buffer function shall not impact water quality.

REFERENCES

Bentrup, Gary 2008. Conservation buffers: design guidelines for buffers, corridors, and greenways. Gen. Tech. Rep. SRS-109. Asheville, NC: Department of Agriculture, Forest Service, Southern Research Station.

PUBLICATION 8332

The Farm Water Quality Plan

Plan components compiled by **MARY BIANCHI,** UC Cooperative Extension Farm Advisor, San Luis Obispo County; **DANIEL MOUNTJOY,** Area Resource Conservationist, USDA–NRCS; and **ALISON JONES,** Watershed Management Initiative Coordinator, Central Coast Regional Quality Control Board.

UNIVERSITY OF CALIFORNIA
Division of Agriculture and Natural Resources
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In partnership with

NRCS
Natural Resources Conservation Service

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Farm Water Quality Planning

A Water Quality and Technical Assistance Program for California Agriculture
http://waterquality.ucanr.org

This PLAN is part of the **Farm Water Quality Planning** (FWQP) series, developed for a short course that provides training for growers of irrigated crops who are interested in implementing water quality protection practices. The short course teaches the basic concepts of watersheds, nonpoint source pollution (NPS), site-assessment techniques, and evaluation techniques. Management goals and practices are presented for a variety of cropping systems.

UC PEER REVIEWED

Use these sections to formalize a Farm Water Quality Plan for your farm.

This is the Farm Water Quality Plan for ______________________________

Prepared by: ______________________________

Date: ______________

CONTENTS

PROPERTY INFORMATION

Farm/Ranch	
Farm/Ranch Name:	
Mailing Address or P.O. Box:	
City, State and Zip Code:	
Phone:	Size (acres):
Owner	
Name(s):	
Mailing Address or P.O. Box: ☐Same as Farm/Ranch Address	
City, State and Zip Code:	
Phone:	E-mail:
Lessee/Manager	
Name(s):	
Mailing Address or P.O. Box: ☐Same as Farm/Ranch Address	
City, State and Zip Code:	
Phone:	E-mail:
Location	
County:	
Legal Description (Township, Range, Sections):	

OPERATIONS AND LAND USE

Current farm/ranch enterprises or activities and the acreage devoted to each

Land use activity	Area in acres/sq.ft.
farming (field production)	
farming (greenhouse/nursery production)	
grazing livestock	
dairy	
feedlot	
processing (winery, cold storage, etc.)	
public facilities (winery tasting rooms, etc.)	
forestry (timber)	
wildlife preserve	
camping	
hunt club	

Water sources for farming enterprises:
☐ Surface water ☐ Groundwater ☐ Municipal ☐ Reclaimed/Recycled

Operations and Land use, cont'd.

Farming Enterprises

Current farm/ranch enterprises or activities and the acreage devoted to each

☐ Alfalfa/other hay	☐ Cotton	☐ Strawberries
☐ Caneberries	☐ Field crops	☐ Tree/fruit/nut crops
☐ Corn (grain)	☐ Irrigated pasture	☐ Vegetable crops
☐ Corn (silage)	☐ Oil crops	☐ Vineyard
☐ Other silage	☐ Rice	☐ Wheat, barley, oats
☐ Greenhouse ☐ Container ☐ Ground	☐ Shade & temporary ☐ Container ☐ Ground	☐ Outdoor flowers ☐ Container ☐ Ground
☐	☐	☐
☐	☐	☐

Schedule for rotated crops:

Livestock Enterprises

Number of pastures for grazing ___________

Types of livestock	Livestock access to water
☐ cow/calf–spring calving	☐ troughs and tanks
☐ cow/calf–fall calving	☐ springs
☐ cow/calf–year-round calving	☐ streams or creeks
☐ stocker production	☐ stock ponds
☐ goat production	☐ water gaps
☐ llama production	☐ wells
☐ horses	☐ river
☐ ratite (ostrich, emu, etc.) production	☐
☐	☐
☐	☐

STATEMENT OF GOALS
Production Goals
☐to pass the farm/ranch on to the next generation
☐to reduce family/farm debt so that only minor borrowing for operating capital is necessary in a typical year
☐to expand existing enterprises
☐to increase income by developing new enterprises
☐to increase profitability
☐to purchase or lease more property
☐to reduce short-term production costs
☐to achieve long-term reduced production costs
☐to increase the value of the land
☐
☐
☐

Quality of Life Goals
☐to reduce energy consumption in our home and in the farm/ranch operation
☐to reduce family debt
☐to provide support for our children's college education
☐to provide financial or other support to community organizations
☐to reduce household operating expenses
☐to build an emergency fund
☐to be involved in at least one significant community activity that is important to our family's goals, health, values, or well-being
☐to build a retirement fund
☐to grow crops or raise livestock during my retirement
☐to enhance relationships with neighbors and the community
☐to enhance health and well-being on the farm
☐
☐

Statement of Goals, cont'd.

Natural Resource/Water Quality Goals
☐to protect cropland, nursery area, rangeland, pastureland, and/or forestland from erosion
☐to manage farm or ranch roads to reduce movement of sediment into streams, and other water bodies
☐to reduce human-caused erosion of stream banks
☐to increase canopy and/or ground cover in riparian areas or along streams and other water bodies
☐to protect and enhance fish populations and other aquatic resources.
☐to reduce concentration of livestock in or near riparian areas, streams or other water bodies
☐to reduce the opportunity for nutrients, pesticides, and pathogens to enter streams or other water bodies.
☐to maintain and enhance riparian plant communities
☐to reduce wildfire hazard
☐to maintain and protect oak woodland and other upland native plant communities
☐to maintain or improve wildlife habitat
☐to reduce/manage invasive weeds
☐
☐
☐

REGIONAL AND LOCAL WATER QUALITY INFORMATION

This section is a place for you to document information about your watershed, groundwater basin, and downstream waterbodies that has been collected by a variety of agencies. This information is documented in the following resources:

California Coastal Commission (CCC)
CCAs http://www.coastal.ca.gov/nps/cca-nps.html

California Department of Pesticide Regulation (DPR)
GWPA Maps
http://www.cdpr.ca.gov/docs/gwp/gwpamaps.htm
GWPA Lists by Legal Description
http://www.cdpr.ca.gov/docs/gwp/gwpa_lists.htm

National Oceanic and Atmospheric Administration (NOAA) – National Marine Fisheries Service (NMFS) Protected Resources Division
ESUs http://swr.ucsd.edu/psd/ps1inf.htm#Salmon

State Water Resources Control Board (SWRCB) – Regional Water Quality Control Board (RWQCB)
Beneficial Uses - Basin Plan
http://www.swrcb.ca.gov/rwqcb3/BasinPlan/BP_text/chapter_2/figs_n_tables/table_2-1.doc
Beneficial Use Support - California Water Quality Assessment Report 1998 - Staff Report Part A
http://www.swrcb.ca.gov/general/publications/index.html#Cc
Clean Water Act Section 303(d) List
http://www.swrcb.ca.gov/tmdl/docs/2002reg3303dlist.pdf
CCAMP Monitoring Data http://www.ccamp.org/ca/3/3.htm

How to complete this section
Draw from the above resources to complete this section. If you don't have access to one of these resources, contact your Watershed Coordinator or contact the agency directly.

Regional and Local Water Quality Information, cont'd.

Location of the Operation — "Watershed Address"

Water Quality Control Board Region

- ☐ Region 1: North Coast
- ☐ Region 2: San Francisco Bay
- ☐ Region 3: Central Coast
- ☐ Region 4: Los Angeles
- ☐ Region 5: Central Valley
- ☐ Region 6: Lahontan
- ☐ Region 7: Colorado River Basin
- ☐ Region 8: Santa Ana
- ☐ Region 9: San Diego

Name of the Hydrologic Unit (HU):

Name of the Hydrologic Area (HA):

Downstream Waterbodies

Type(s) of streams on and adjacent to the farm/ranch:

- ☐ Perennial – flow all year
- ☐ Intermittent – flow during and for a period following rainfall
- ☐ Ephemeral – only flow in direct response to rainfall
- ☐ None

List names of all downstream waterbodies, beginning at the property and ending at the ocean:

Pollutants identified in downstream waterbodies:

☐ Sediment/Silt Waterbody: ______________ Source: ☐ 303(d)*
☐ Cooperative Monitoring ☐ Other ______________

☐ Nutrients/Nitrate Waterbody: ______________ Source: ☐ 303(d)*
☐ Cooperative Monitoring ☐ Other ______________

☐ Pesticides Waterbody: ______________ Source: ☐ 303(d)*
☐ Cooperative Monitoring ☐ Other ______________

☐ Other(s) Waterbody: ______________ Source: ☐ 303(d)*
☐ Cooperative Monitoring ☐ Other ______________

*Waterbodies on Federal 303(d) list are subject to Total Maximum Daily Loads.

Is the watershed you are in designated by the Department of Fish and Game as being within a known range of an Evolutionary Significant Unit (ESU) for Coho or Steelhead?

Coho ESU? ☐ Yes ☐ No
If yes, are the Coho Threatened or Endangered? ☐ T ☐ E

Steelhead ESU? ☐ Yes ☐ No
If yes, are the Steelhead Threatened or Endangered? ☐ T ☐ E

Regional and Local Water Quality Information, cont'd.

Is a coastal zone downstream of the operation designated by the California Coastal Commission as a proposed Critical Coastal Area (CCA)? ☐ Yes ☐ No
Groundwater Basin
Name and Number of the Groundwater Basin:
Is the farm/ranch within an area designated by the California Department of Pesticide Regulation as a Ground Water Protection Area (GWPA)? ☐ Yes ☐ No
Include maps that indicate your watershed, groundwater basin, and flow of water from your operation to the ocean.

FARM/RANCH MAP

Facilities and Resources
Keep maps and photographs with Plan for reference

Indicate the acres within the boundary, number of each facility and hydrologic feature, and miles of road and fencing. Rough estimates are adequate for miles.

Shown on map	Boundaries		Total Acres
☐	Farm or ranch boundary		
☐	Field boundaries		
☐			
	Buildings		**Total Number**
☐	Residence, offices	office	
☐	Barns/shops/outbuildings	barn	
☐	Pesticide storage	pesticide	
☐	Fertilizer storage	fertilizer	
☐	Petroleum storage	petroleum	
☐	Dairy or other animal handling facilities		
☐	Livestock waste management facilities		
☐	Greenhouses	greenhouse	
☐	Shade houses, other temporary structures		
☐	Soil handling/mixing, compost areas	stack yard	
☐	Boiler rooms		
☐	Cold storage, postharvest handling		
☐			
	Structures		**Total Number**
☐	Equipment yards		
☐	Corrals		
☐	Feedlots	feedlot	
☐	Septic tanks, other bathroom facilities	ST M W	
☐	Stockwater storage tanks	water tank	
☐	Stockwater troughs		
☐	Erosion control structures 58		
☐			

Farm/Ranch Map, cont'd.

	Fences and Roads		Total Miles
☐	Fences		
☐	Dirt road		
☐	Gravel road 59	gravel	
☐	Paved road		
☐			
	Hydrologic Features		**Total Number**
☐	Irrigation ditches		
☐	Irrigation ditches, lined 59	lined	
☐	Streams and creeks		
☐	Springs		
☐	Irrigation reservoirs	R	
☐	Recycling reservoirs 59	R recycling	
☐	Irrigation settling ponds 59	settling pond	
☐	Stockwater ponds		
☐	Tailwater recovery systems 59	tailwater recovery system	
☐	Bridges		
☐	Stream crossings	FORD	
☐	Domestic wells 59	domestic well	
☐	Irrigation wells		
☐	Stockwater wells 59	well	
☐			

Site Assessment and Practices Planning–Sediment, cont'd.

Managing Sediment

Soil erosion and sediment deposition are primary contributors to lowered surface water quality from farmlands. In areas where there are steep slopes, erodible soils, and intense storm characteristics, sediment delivery from farmlands can be relatively high. Roads and other areas of disturbed ground where bare soils are susceptible to the erosive action of water and wind can also be major contributors of sediment to waterbodies.

Upstream/Upslope Land Use

S1. Is your property affected by sediment from upstream/upslope land uses?
☐ Yes ☐ No

Notes:

Practices to Manage Sediment from Upstream/Upslope

	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
A structure to collect the sediment is installed and maintained									
Sediment Basin #350									
Water and Sediment Control Basin #638									
A structure to divert the sediment is installed and maintained									
Diversion #362									
Grassed Waterway #412									
Lined Waterway #468									
Open Channel #582									
Structure for Water Control #587									
Surface Drainage Ditch #607 & #608									
Underground Outlet #620									
Vegetation is established to filter the sediment									
Conservation Cover #327									
Filter Strip #393									
Tree/Shrub Establishment #612									

SITE ASSESSMENT AND PRACTICES PLANNING

You have completed the basin water quality information that lists important water bodies in your area and the water quality problems that have been identified for these water bodies. You have also created a map of your farm or ranch that lists land uses, facilities, and resources.

The following section can help identify areas of your farm or ranch where you've already implemented management practices to protect water quality. It can also help determine what areas of your farm or ranch can receive the most benefit from the implementation of new management practices. These items can be added to your map.

A trip around the property in a vehicle or on foot may be necessary to complete this assessment. Some of the assessment may involve accessing your pesticide use reports, or operations budget for nutrients applied to specific fields. Keep this section and the following self-evaluation section as a working document to record your decisions and your progress. You should keep records or take photographs before and after implementation to document changes that occur as a result of practices or groups of practices.

If you conclude that you need to make some changes, it may take you a while to decide how to proceed. You may want to compare practices that can accomplish the same thing. Not all practices listed may be applicable or available for your situation. Discuss these options with other farmers, consultants, or technical advisors from UCCE, NRCS, RCDs or other organizations. You should estimate costs of implementation. You may want to seek cost share funding with NRCS or other sources.

How to complete this section:

If you answer "yes" to any of the questions, look at the following table(s) for Management Practices. Select Practices that you are currently using or that you think might be useful. Update annually and keep notes that help with record keeping. If you would like to be more specific, you can record block designations, square footage, or acres of each selected Practice in the "location(s)" column. NRCS Conservation Practice Standards that you might want to use are listed where applicable.

Site Assessment and Practices Planning–Sediment, cont'd.

Fields and Other Growing Areas

S2. Do you notice soil erosion from fields and other growing areas with steep slopes or long lengths of run?
☐ Yes ☐ No

Notes:

Develop a Field Layout to Minimize Erosion Potential									
	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Rows are placed on slopes and grades that minimize erosion									
Contour Farming #330									
Contour Orchard and Other Fruit Area #331									
Row Arrangement #557									
Long runs are broken up									
Access Road #560									
Contour Buffer Strip #332									
Diversion # 362									
Irregularities that cause concentrated runoff on slopes are removed									
Land Smoothing #466									

Site Assessment and Practices Planning–Sediment, cont'd.

S3. During rain events, do you notice soil erosion from fields with bare soil or sparse ground cover?
☐ **Yes** ☐ **No**

Notes:

Cover Bare Fields to Reduce Rainfall Runoff Potential									
	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Bare soil is covered with vegetation									
Conservation Crop Rotation #328									
Cover Crop #340									
Alternate rows are cultivated and cover cropped									
Cover Crop #340									
Plant residues or other materials are applied to or managed on the soil surface									
Mulching #484									
Residue Management #329									
Strips of vegetation are placed along rows that are farmed on the contour									
Contour Buffer Strip #332									
Critical Area Planting #342									

Site Assessment and Practices Planning–Sediment, cont'd.

S4. During irrigation, do you notice sediments in runoff from fields?
☐ Yes ☐ No

Notes:

Manage Irrigation Water to Minimize Erosion Potential									
	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Amendments are used to improve infiltration - PAM, gypsum, organic amendments									
Anionic Polyacrylamide (PAM) #450									
Deep tillage is performed to fracture restrictive soil layers and increase deep percolation where leaching of pollutants to groundwater is not a significant risk									
Deep Tillage #324									
Soil or substrate moisture status is monitored using tensiometers or other sensors									
The application rate of the irrigation system (in/hr) is known									
Irrigation system is redesigned or converted to another type									
Fields are graded for uniform application of irrigation water									
Irrigation Land Leveling #464									
Irrigation Water Management #449									

Site Assessment and Practices Planning–Sediment, cont'd.

S5. During high winds, do you notice dust blowing from fields with bare soil or sparse ground cover or from field roads?
☐ **Yes** ☐ **No**

Notes:

Reduce Wind Erosion Potential									
	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Vegetation is established along the field edges to shield the field from wind									
Hedgerow #422									
Herbaceous Wind Barrier #603									
Windbreak/Shelterbelt Establishment #380 & 650									
The bare soil is covered with vegetation									
Cover Crop #340									
Conservation Crop Rotation #328									
Residue Management #329									
The soil surface is roughened									
Cross Wind Ridges #589A									
Surface Roughening #609									
Road surfaces are protected with mulch, gravel, water or an environmentally safe dust suppressant									
Access Road #560									
Mulching #484									

Site Assessment and Practices Planning–Sediment, cont'd.

Container Grown Plants, Including Hydroponics

S6. Do you grow plants in containers in a system that doesn't recover all applied water?
☐ Yes ☐ No

Notes:

Reduce Erosion and Runoff in Container Grown Plants	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Plants are grouped to increase water and nutrient use efficiency by container size, container design, age, canopy architecture, water and nutrient requirements and/or salt tolerance									
Plants are consolidated and irrigation is shut off in unused portions									
Containers are filled and packed uniformly									
Growing media and/or substrate is selected for high water holding capacity and adequate drainage and aeration									
Growing media and/or substrate is stored and mixed in a location sheltered from wind and away from drainage channels									
Mulch is used to protect ground surface below containers from erosion.									

Site Assessment and Practices Planning–Sediment, cont'd.

Roads and Roadside Ditches

S7. Do you notice rills, gullies or headcuts running down the road?
☐ Yes ☐ No

Notes:

S8. Do you notice water-loving vegetation present on the roadbed?
☐ Yes ☐ No

Notes:

S9. Is an outboard berm channeling water down the road?
☐ Yes ☐ No

Notes:

S10. Do you notice tension cracks on the road surface or outboard fill?
☐ Yes ☐ No

Notes:

Protect Road Surface from Concentrated Runoff

	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Road placement, grade, and surface conditions are assessed for proper drainage									
Roads are graded to reduce erosion									
Access Road #560									
Roadbeds and/or banks are covered in the winter or during minimal use									
Cover Crop #340									
Critical Area Planting #342									
Erodible soil on the roadbed is permanently protected with road oil, gravel, mulch, or paving									
Access Road #560									
Mulching #484									
Outboard berms are removed									
Access Road #560									

Site Assessment and Practices Planning–Sediment, cont'd.

	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Ditches and culverts are kept clean of debris									
Water is diverted away from unstable slopes									
Diversion #362									
Unstable slopes are treated									
Cut Bank Stabilization #742									

Site Assessment and Practices Planning–Sediment, cont'd.

Non-Cropped & Non-Road Areas

S14. Do you notice erosion or sediment loss from areas of bare soil in areas such as cut banks, field margins, between field blocks or greenhouses, on abandoned slopes, soil mixing/handling or compost areas, equipment yards, parking areas, and postharvest or cold storage facilities?
☐ Yes ☐ No

Notes:

S15. Do you see signs of or the potential for sheet erosion, rill erosion, gullies, headcuts, mudslides, or landslides in steep non-cropped areas?
☐ Yes ☐ No

Notes:

Reduce Erosion from Non-cropped Areas

	Used or could be helpful	Location(s)	Year(s) used 2004	2005	2006	2007	2008	2009	2010
Protect Soil									
Bare soil is covered with vegetation or mulch									
Conservation Cover #327									
Critical Area Planting #342									
Filter Strip #393									
Hedgerow Planting #422									
Mulching #484									
Range Planting #550									
Tree/Shrub Establishment #612									
Vegetation is allowed to reestablish by excluding animals, people or vehicles									
Use Exclusion #472									
Regrade Potential Problem Areas									
Potential landslide areas are stabilized by reducing and/or supporting the slope									
Cut Bank Stabilization #742									
Landslide Treatment #453									
Gullies are stabilized or reshaped									
Critical Area Planting #342									
Grade Stabilization Structure #410									
Structure for Water Control #587									

Site Assessment and Practices Planning–Sediment, cont'd.

	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Divert Water to a Stable Outlet									
Channels or conduits to divert water to a stable outlet are installed or improved									
Diversion #362									
Grassed Waterway #412									
Lined Waterway #468									
Open Channel #582									
Subsurface Drain #606									
Structure for Water Control #587									
Surface Drainage Ditch #607 & #608									
Underground Outlet #620									
Facilities roof runoff is collected and diverted to a stable outlet									
Roof Runoff Management #558									

Site Assessment and Practices Planning–Sediment, cont'd.

Sediment Leaving the Operation

S16. Do you notice sediment moving off the farm after irrigation and/or storm events?
☐ Yes ☐ No

Notes:

S17. Do you notice sediment accumulating in ditches, channels, ponds, or other waterways downstream of the farm?
☐ Yes ☐ No

Notes:

Detain or Filter Eroded Sediment Leaving the Operation	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Structures to divert sediment to settling areas are installed and maintained									
Diversion #362									
Lined Waterway #468									
Open Channel #582									
Structure for Water Control #587									
Surface Drainage Ditch #607 & #608									
Underground Outlet #620									
Structures to collect sediment are appropriately sized, installed and maintained									
Irrigation System, Tailwater Recovery #447									
Sediment Basin #350									
Water and Sediment Control Basin #638									
Vegetation is established to filter sediment									
Conservation Cover #327									
Filter Strip #393									
Grassed Waterway #412									

Site Assessment and Practices Planning–Sediment, cont'd.

Managing Irrigation

Efficient irrigation management maximizes water use for crop production and minimizes water losses caused by runoff, evaporation, and deep percolation. A portion of the water applied during an irrigation benefits crop growth by providing moisture for transpiration, preventing the build up of salts in the root zone, and moderating the air temperature around the crop. The remainder of the applied water that is lost through run-off and deep percolation not only wastes water, energy, and fertilizer, but can also transport sediments, nutrients and pesticides into ground and surface water supplies.

I1. Does tailwater or runoff water leave the operation during irrigation events?
☐ Yes ☐ No

Notes:

I2. Could you irrigate more efficiently to reduce the amount of water that leaches out of the root zone to eventually reach the groundwater?
☐ Yes ☐ No

Notes:

Manage Irrigation Water for Maximum Efficiency

	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Maximize Irrigation System Efficiency									
Irrigation efficiency is evaluated by an irrigation mobile lab, UCCE, or a consultant									
Irrigation Water Management #449									
Regular system maintenance is performed									
Irrigators are trained in practices that promote efficient irrigation									
Amendments are used to improve infiltration - PAM, gypsum, organic amendments									
Anionic Polyacrylamide (PAM) #450									
Deep tillage is performed to fracture restrictive soil layers and increase deep percolation where leaching of pollutants to groundwater is not a significant risk									
Deep Tillage #324									

Site Assessment and Practices Planning–Sediment, cont'd.

	Used or could be helpful	Location(s)	Year(s) used						
			2004	2005	2006	2007	2008	2009	2010
Optimize Irrigation Scheduling									
Daily water use is estimated using resources such as CIMIS data , evapotransporation (ET), atmometers and/or irrigation records									
Soil or substrate moisture status is monitored using tensiometers or other sensors									
Irrigations are scheduled during times that minimize ET losses									
The application rate of the irrigation system (in/hr) is known									
Plant rooting depths are known									
The irrigation schedule is adjusted to account for the leaching fraction and distribution uniformity of the system									
Timers automatically shut off irrigation after a prescribed time									
Records are kept of the irrigation schedule and water applied during each irrigation									
Optimize Irrigation System Design									
Irrigation system is properly designed and maintained or is converted to another type									
Irrigation Water Management #449									
Irrigation System, Microirrigation #441									
Irrigation System, Sprinkler #442									
Fields are graded for uniform application of irrigation water									
Irrigation Land Leveling #464									
Irrigation water conveyance system (main, canals, etc...) is properly designed and maintained or upgraded									
Irrigation Water Conveyance Pipeline #430									

Exhibit 16

FARM WATER QUALITY PLAN

Date of Preparation **Date of Latest update:**

Section 1: General Farm Information – NOI info

1. Name of Farm or Operation

2. Farm / Site Address

3. County

4. APN (Assessors Parcel Number(s)

5. Name of Farmer / Operator

   Mailing address

   Phone number (work / cell)

   Email address (if applicable)

6. Name of Land Owner if different than farmer/operator

   Contact information (address or phone number)

7. Total acres

8. Total irrigated farmed acres

9. Which crops are grown on the farm?

Section 2: Watershed/Runoff issues

10. Name of Watershed

and subwatershed (if known)

11. What is the name of the nearest downstream waterbody (stream, river, lake, etc.).?

How close is your farm to the waterbody ?

12. Does runoff from your irrigation or rain on the irrigated area drain to the waterbody?

☐ yes ☐ no

If yes, where is your closest drainage point into that waterbody?

☐ adjacent? ☐ less than 250 feet? ☐ less than 1000 feet? ☐ greater than 1000 feet?

Mark the drainage point on your map.

13. How would you characterize the flow of the waterbody?

☐ Perennial – flows all year long

☐ Intermittent – flows during and for a period following rainfall

☐ Ephemeral – only flows in direct response to rainfall

14. If your farm is adjacent to a waterbody, describe the condition of the riparian corridor (the vegetated area right along the stream).

☐ Lots of trees ☐ partly covered ☐ very few trees/bushes ☐ bare

(attach photo as documentation).

15. Is the waterbody (stream, river, lake) listed as "impaired" on the state's list of impaired waterbodies (the "303d" list) due to agricultural sources? ☐ yes ☐ no

If yes, what is/are the listed problem(s) attributed to ag runoff? (i.e. nitrates, toxicity, turbidity, etc.)

Note: You can look up your waterbody in the 303d list of impaired waterbodies at: http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml

16. Does the farm irrigation water runoff (tail water) drain off of your property?

☐ yes ☐ no

If yes, to where does it drain? (describe below) :

☐ to neighbor's property ☐ to ditch ☐ to creek ☐ other (explain).....

17. Does the farm have tile drains to move subsurface water? ☐ yes ☐ no

If yes, to where do they drain? (describe below) :

☐ to neighbor's property ☐ to ditch ☐ to creek ☐ other (explain).....

18. Does water from your irrigated land discharge from your property during storm events?

☐ yes ☐ no

If yes, under what conditions does water run off during storms?

☐ During most rain events

☐ Only during heavy storms

☐ Only after soil is saturated

(include map showing drainages)

If yes, to where does it drain? (describe below) :

☐ to neighbor's property ☐ to ditch ☐ to creek ☐ other (explain).....

19. Does water from other sources run on to your property? ☐ yes ☐ no

If yes, where?

Mark location on your farm map

What are you doing about it? (describe)

Note: Section 3 is awaiting approval of the new Ag Waiver. You do not need to complete it until then.

Section 3: Determination of Tiers (Decision tree should be attached) – and required elements

- ☐ Tier 1
- ☐ Tier 2 with low or moderate Potential Hazard of Nitrate Leaching
- ☐ Tier 2 with a high Potential Hazard of Nitrate Leaching
- ☐ Tier 3

Section 4: Recommended Maps (mark all that are included and attach here). **Note that the Ag Commissioner, NRCS, RCD, and Farm Bureaus can also help you get these maps at no cost.**

Necessary Maps:

- ☐ Area map (map of area showing the main local streets with farm site flagged – can be as simple as a copy of a local or Google map)
- ☐ Location map (shows closest roads and outlines borders of farm; (e.g.; pesticide permit map). This is the map that you attached to your NOI
- ☐ Farm map showing fields, drainages, wells, roads (can be hand drawn)

Useful Maps (optional)

- ☐ County Assessor's map (APN map)
- ☐ Watershed map of adjacent and downstream waterbodies (streams, rivers, etc.)
- ☐ Farm map showing Fields / Crops (can be hand drawn)
- ☐ Soil map(s) (one source is: http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm)
- ☐ Maps showing major events that have affected your runoff (e.g.; historical maps, landslides, earthquake faults, area hit by a major fire, etc.)
- ☐ Other (describe)

Section 5: Irrigation System

20. Source of Irrigation Water (check all that apply)

- Ground water (well) ☐
- Surface water (creek or pond) ☐
- Recycled water (from on-site or from purple pipe) ☐
- Imported water or city water ☐
- Spring ☐

21. Describe system (check all that apply)

Drip	☐	Microsprinkler	☐
Sprinkler	☐	Furrow	☐
Hand	☐	other	☐

Sprinkler for plant establishment, then convert to drip ☐

22. Does your irrigation system have a flow meter?

☐ yes ☐ no

If no, how do you measure the amount of water that you are applying?

23. Has system been evaluated for efficiency and uniformity of distribution?

☐ yes ☐ no

If yes, attach a copy of evaluation in this section

Did you implement any of the evaluation recommendations? ☐ yes ☐ no

If yes, which ones?

If no, do you plan to implement some of the recommendations in the future? ☐ yes ☐ no

If yes, which ones do you plan to implement?

24. Does any water run off of your property during irrigation? ☐ yes ☐ no

If no, did you have to implement any practices to manage/control it? What did you do?

If yes, what are you doing to manage it? Explain and attach your documentation, if any.

25. Using the form below, record what practices you have used, where you used them and how they worked:

Irrigation Practices to Reduce Runoff	Practice currently in use (# acres)	Practice tried – Did Not work	Practice Under consideration (where)	N/A
Make your irrigations efficient				
Evaluate irrigation efficiency/distribution uniformity (e.g.; by irrigation mobile lab, UCCE, consultant)				
Upgrade/redesign irrigation equipment/system				
Upgrade Water Conveyance System (main lines, etc)				
Train irrigators				
Use catch trays/cups to evaluate amount of applied water				
Use daily CIMIS data to adjust irrigation schedule				
Calculate the field application rate of the irrigation system (in/hr)				
Adjust irrigation schedule for leaching fraction and distribution uniformity of system.				
Maintain records of irrigation schedule				
Maintain records of the amount of water applied during each irrigation				
Monitor soil moisture				
Monitor on-site rain gauges				
Install flow meters				
Improve Sprinkler Irrigation Uniformity				
Perform regularly scheduled system maintenance				
Repair leaks on main and lateral				
Maintain sprinkler heads				
Use sprinkler heads with a high uniformity rating				
Use appropriate nozzle size for lateral spacing and head pattern				

Maintain uniform nozzle size				
Use consistent riser heights and maintain risers perpendicular to ground				
Maintain appropriate system pressure				
Record system flow rate and pressures (head and tail)				
Use a closer lateral line spacing to improve overlap of pattern				
Use flow control nozzles when pressure is too high or variable				
Operate in low-wind conditions				
Minimize lateral spacing where practical				
Offset starting location of hand move lines				
Improve Drip Irrigation Uniformity				
Select drip tape/emitter with an application rate that matches system design, soil or substrate type, and crop needs				
Develop a maintenance plan appropriate for a drip system				
Use a filter appropriate for water quality				
Repair leaks on mains and laterals				
Regularly flush/clean filters				
Flush lateral lines regularly				
Use emitters that minimize pressure differences				
Use drip tape with a small emitter discharge exponent				
Use a pressure regulator for each submain				
Check and adjust pressures of submains				
Shorten lateral hose runs				
Use pressure compensating emitters.				
Manage water quality for potential clogging (high bicarbonates)				
Chlorinate lateral lines to prevent bacterial and algal build-up and root intrusion into emitters				
Keep water where you want it				
Ensure rows are aligned for proper drainage and to reduce erosion				
Improve soil infiltration through amendments				
Install engineered controls				
Convert Irrigation System to another type				
Install Structures for Water Control including:				
• Tailwater recovery system				
• Settling ponds				
• Underground pipes to redirect water				
• Surface Drains				
• Subsurface Drain				
• Recirculating sub-irrigation system				

Check your success in stopping irrigation water runoff by:

1. **Walking the property perimeter during irrigation to look for runoff areas**
2. **Taking pictures before and after you install practices**

Re-evaluate irrigation practices if you see runoff during irrigation.

Section 6: Groundwater

26. Is the farm within 1000 feet of a public well that is impaired by high nitrate contamination?

☐ yes ☐ no

27. Are there any wells currently operating on the farm?

☐ yes ☐ no

If yes, how many?

If yes, are they being used for domestic use, irrigation water, or both?

How many for domestic use?

How many for irrigation use?

If yes, do any of your wells exceed the drinking water standard (10 ppm N or 45 ppm NO3-N)?

☐ yes ☐ no ☐ don't know

28. If wells are used for irrigation, do you apply fertilizer through the irrigation system directly to the fields?

☐ yes ☐ no

If yes, do the wells have back-flow devices installed to prevent groundwater contamination?

☐ yes ☐ no ☐ don't know

29. Are there any wells on the farm which were drilled but are not in use? ☐ yes ☐ no

If yes, are they decommissioned appropriately? ☐ yes ☐ no

Note: NRCS standards for well decommissioning are available at:
http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_025736.pdf

Section 7: Nutrient Management

Nutrients are primary contributors to lowered surface water quality. In areas where irrigation water runs off of the farm, excess nutrients run off too. If the land is overwatered, nutrients are leached below the root zone and, from there, can get into the groundwater. Nutrient sources associated with agricultural production practices include fertilizers and other amendments, biodegradation of crop residues, agricultural and municipal waste applied to land, and waste generated by animals. Nutrients from these sources become pollutants when they are transported offsite into nearby streams and lakes or leach to groundwater. Nitrates and phosphates in surface water bodies contribute to eutrophication. Eutrophication leads to increases in aquatic plants and algal blooms that deplete dissolved oxygen, impacting aquatic organisms. Nitrate pollution of groundwater is widespread and a serious problem statewide because of impacts to drinking water.

30. Do you apply soil amendments and/or fertilizer on your fields? ☐ yes ☐ no

31. How is the fertilizer applied?

☐ Surface application

☐ Through the irrigation system

☐ Combination

32. How do you determine when and how much fertilizer to apply?

☐ Crop advisor (CCA)

☐ Soil tests (i.e. Nitrate quick test or lab results)

☐ Tissue samples from crop

☐ Standard farming practice for this crop (describe)

☐ Other; explain

33. Do you store fertilizer on this farm? ☐ yes ☐ no Where?
mark storage and mixing sites on your farm map

34. Is your farm adjacent to or does drain towards a water body which is impaired (303d list) due to nutrients or nitrates? (see Section 2, Question 15 above)

☐ yes ☐ no

If yes, it is important that you complete this section

35. Do you plant crops that the University of California Center for Water Resources (WRC) Nitrate Groundwater Pollution Hazard Index identifies as a high risk for nitrate loading to groundwater (Beet, Broccoli, Cabbage, Cauliflower, Celery, Chinese/Napa Cabbage, Collard, Endive, Kale, Leek, Lettuce, Mustard, Onion, Spinach, Strawberry, Pepper, or Parsley)?

☐ yes ☐ no

36. Based on the completed worksheet (attached)(Note: you can use formula for either crop, irrigation system type and soils or crop, or irrigation system and irrigation water nitrate concentration), the Nitrate Loading Risk Factor for this farm is:

☐ Low ☐ Moderate ☐ High

Go to agwaterquality.org for the worksheet and instructions
What practices have you used? Fill out the form below and attach any documentation:

Practices for Managing Nutrients	Practice currently in use (# acres)	Practice tried – Did Not work	Practice Under consideration (where)	N/A
Optimize fertilizer application				
Control over watering				
Manage fertigations to avoid nutrient loss below the rootzone				
Understand how much fertilizer your crop needs				
Take Tissue samples for N and P status before applying fertilizer				
Time fertilizer application according to crop requirements				
Do not apply fertilizers when rain is expected				
Monitor your irrigation water to determine pre-existing N and P levels				
Monitor the N and P in soil amendments before				

use				
Use controlled release fertilizer alone or with a liquid feed				
Test nitrogen levels before pre-side-dressing				
Split fertilizer applications				
Use precision to place fertilizer over root zone				
Do soil quick-tests or soil analysis to check for nitrogen remaining in soil				
Store and handle nutrients properly				
Calibrate sprayers and injectors				
Mix and load fertilizer on low runoff hazard sites – over 100 feet downslope of the well on an impermeable surface				
Make sure that your fertilizer storage facility includes a concrete pad and curb to contain spills and leaks				
Monitor and maintain your septic/port-a-potty systems				
Keep nutrients from blowing away				
Plant hedgerows and/or windbreaks				
Plant cover crops				
Mulch to keep bare soil in place				
Keeping nutrients from washing away				
Plant cover crop that use nitrogen in the soil				
Manage plant residue to hold soil in place				
Ensure rows are aligned for proper drainage and to reduce erosion				
Plant filter strips at field edges and row ends				
Cover bare soil with grass, mulch				
Divert runoff to a grassed area or sediment basin on your property				
Installed engineered control systems:				
Vegetated treatment systems				
Treatment wetlands				
Convert irrigation system to reduce runoff				
Reuse tailwater				
Treat tailwater				

Check your success in stopping nutrient runoff by:

1. **Walking the property perimeter in big rainstorms to look for runoff areas**
2. **Looking for blowing soil during high winds,**

3. **Taking pictures before and after you install practices**

If you see erosion or storm runoff with sediment, go back and re-evaluate practices.

Section 8: Sediment / Erosion

Soil erosion and sediment deposition are primary contributors to lowered surface water quality from farmlands. In areas where there are steep slopes, erodible soils, and intense storm characteristics, sediment delivery from farmlands can be relatively high. Roads and other areas of disturbed ground where bare soils are susceptible to the erosive action of water and wind can also be major contributors of sediment to waterbodies.

37. Is your farm adjacent to or does drain towards a water body which is impaired (303d list) due to sediment or turbidity (cloudiness)? (see Section 2, Question 15 above)

☐ yes ☐ no

If yes, it is important that you complete this section

38. Is any sediment coming onto your property and causing a problem?

☐ yes ☐ no

You should document this with photographs. Contact the NRCS, Coalition or other conservation / technical provider for technical assistance.

39. Does any sediment run off of your property during irrigation? ☐ yes ☐ no

If no, have you had to implement any practices to control it? ☐ yes ☐ no

What did you do?

If yes, what are you doing to stop it? Explain and attach any documentation here.

40. Does any sediment run off of your property during winter storm events? ☐ yes ☐ no

If no, have you implemented any practices to control sediment runoff? ☐ yes ☐ no

What did you do? Fill out the form below and attach any documentation:

Practices for Managing Sediment	Practice currently in use (# acres)	Practice tried – Did Not work	Practice Under consideration (where)	N/A
Keeping soil on the field				
Manage prior year crop residue				
Ensure rows are aligned for proper drainage and to reduce erosion				
Plant buffer strips at field edges and row ends				
Use Polyacrylimide (PAM) in irrigation water				
Cover bare soil with grass or mulch				
Don't over water				
Practices to reduce sediment from access roads				
Grade road to reduce on road erosion				
Control concentrated drainage on road (culverts, rolling dips, etc				
Direct drainage off road (to vegetative areas, ditches, sediment basins, etc)				
Protect roads in rainy season: seed roads, rice straw, gravel, avoid use, etc)				
Reduce erosion on non-crop areas of farm				
Plant Filter/Buffer Strips				
Grass the waterways				
Establish trees/shrubs along the perimeter				
Practices to reduce wind erosion				
Plant hedgerows				
Plant windbreaks / shelterbelts				
Plant Cover Crops				
Mulch uncovered soil				
Leave residue from prior crop on soil until you are ready to plant				
Install structures for sediment control:				
Sediment Basin				
Underground Outlet pipe to redirect water				
Lined waterways				

Check your success in stopping sediment runoff by:

1. **Walking the property perimeter in big rainstorms to look for runoff areas**
2. **Being sure that drainage to ditches and streams are not concentrated so that they don't cause erosion!**
3. **Looking for blowing soil during high winds,**
4. **Taking pictures before and after you install practices**

If you see erosion or storm runoff with sediment, go back and re-evaluate practices.

Section 9: Pesticides

Pesticides that move from the application site into surface or groundwater can affect the beneficial uses of water through their potential impact on human and animal health, and on non-target organisms. Wind and water erosion of soil, or drift from pesticide applications may contribute to pesticide movement away from the target area. Pesticides may enter surface waters in irrigation return flows and tile drainage either as water-soluble residuals or adsorbed to sediments. Groundwater in agricultural areas may also be subject to pollution from pesticides when deep percolation from irrigated land carries water soluble pesticides to the groundwater.

41. Do you use pesticides on this farm? ☐ yes ☐ no

42. Which management method best describes your farming operation?

☐ Organic ☐ Conventional ☐ Both

43. Do you store pesticides on this farm? ☐ yes ☐ no Where?

Mark storage and mixing sites on your farm map

44. Do you apply Diazinon on this farm? ☐ yes ☐ no

45. Do you apply Chlorpyrifos on this farm? ☐ yes ☐ no

46. Is your farm adjacent to or does drain towards a water body which is impaired (303d list) due to toxicity or pesticides? (see Section 2, Question 15 above) ☐ yes ☐ no

If yes, it is important that you complete this section

47. Who is your pesticide crop advisor?

48. Who is the pesticide applicator (☐ in house or ☐ contracted out)

Name of applicator (or company)

Applicator number:

49. Do you keep the Pesticide Use reports on site? ☐ yes ☐ no

(Use reports may be included in the attachments)

50. Have you implemented practices to control pesticide movement off your farm (see list below for practices that you may have implemented)? Did they work? Fill out the form below and attach any documentation.

Practices to Reduce Pesticide Movement with Water, Wind, and Eroding Soil	Practice currently in use (# acres)	Practice tried – Did Not work	Practice Under consideration (where)	N/A
Storage and Disposal Practices				
Label instructions are followed				
Store pesticides in a facility includes a concrete pad and curb to contain spills and leaks				
Calibrate sprayers and injectors				
Train pesticide handlers and applicators yearly				
Keep equipment clean of soil and plant parts as you move between fields				
Do all mixing and loading in low runoff hazard sites or impermeable surface at least 100 feet downslope of the well				
Minimize drift by spraying pesticides during low wind conditions				
Dispose of excess pesticides per label instructions				
Application Practices				
Install hedgerows or windbreaks				
Use filter strips in erosion areas				
Consult and follow label directions				
Consider the likelihood of ditch and surface water contamination prior to pesticide application				
Consider potential impact of rain events prior to pesticide application				
Recover and treat or reuse tailwater				
Use Integrated Pest Management practices to reduce pesticide need				

Section 10: Technical Assistance

51. Have you worked with anyone to address water quality issues in the past? ☐ yes ☐ no

If yes, explain who you worked with and what your results ?

Section 11: Review of water quality goals and issues relating to this farm which can be and are being addressed

52. What are the Water Quality goals (objectives) for this farm?

53. Do you have potential water quality problems that you plan to address over the next two years? (If yes, describe. As you work on the problem, attach before and after documents/photos here.)

54. Is there anything that you have done to address these issues in the past that you haven't noted above? If so, what did you implement that worked? What did you implement that didn't work? Attach before and after documents/photos here) -

55. Are there other solutions (not noted above) that you are considering to help you achieve your goals? If so, what are they?

56. How are you assessing the effectiveness of these solutions?

Section 12: Attachments (Optional) - Check if attached

- ☐ Decision tree used to determine "Tier"
- ☐ Worksheet used to determine Nitrogen Risk Factor of crops grown
- ☐ Worksheet used to determine Nitrate Loading Risk Factor of the farm
- ☐ Photo monitoring (be sure to date!)
- ☐ Pesticide Use reports
- ☐ Soils information
- ☐ Soil Nitrate Quick Tests
- ☐ Nitrogen, Nitrate, or Phosphate test results
- ☐ Water testing: (include any results or reports in this section)
  - ☐ Irrigation water for nitrates and/or phosphates
  - ☐ Well water for multiple constituents

Exhibit 17

IRRIGATION WATER MANAGEMENT

PRACTICE INTRODUCTION

USDA, Natural Resources Conservation Service - practice code 449

Irrigation Water Management - Determining and controlling the rate, amount and timing of irrigation water in planned and efficient manner.

PRACTICE INFORMATION

The purpose of this practice is to effectively use available irrigation water in managing and controlling the moisture environment of crops and other vegetation. The objectives are to promote a desired response, minimize soil erosion, minimize loss of plant nutrients, and protect both the quantity and quality of water resources.

This practice is applicable to all areas that are suitable for irrigation and have a water supply of suitable quality and quantity. In addition, a suitable irrigation system must be available and the irrigator needs to have the knowledge and capability to manage irrigation water. The following knowledge is required to properly manage irrigation water:

1. How to determine when to apply water based on the rate of use by the crops at various stages of growth.
2. How to measure or estimate the amount of water required for each irrigation.
3. The time needed for the soil to absorb the required amount of water.
4. How to detect changes in intake rate.
5. How and when to adjust stream size, application rate, and irrigation time to compensate for changes in the soil or topography that effect intake rate.
6. How to recognize erosion caused by irrigation.
7. How to evaluate the uniformity of water application.

Evaluating the efficiency of applying irrigation water is expensive and time consuming. Therefore, the physical irrigation system and the technician's evaluation of the irrigators knowledge is acceptable in determining whether or not good irrigation water management is being practiced.

Additional information including standards and specifications are filed in the local NRCS Field Office Technical Guide.

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

IRRIGATION WATER MANAGEMENT

(Ac.)

CODE 449

DEFINITION

The process of determining and controlling the volume, frequency and application rate of irrigation water in a planned, efficient manner.

PURPOSE

This practice may be applied as part of a resource management system to achieve one or more of the following purposes:

- Manage soil moisture to promote desired crop response.
- Optimize use of available water supplies.
- Minimize irrigation induced soil erosion.
- Decrease non-point source pollution of surface and groundwater resources.
- Manage salts in the crop root zone.
- Manage air, soil, or plant micro-climate.
- Proper and safe chemigation or fertigation.
- Improve air quality by managing soil moisture to reduce particulate matter movement.
- Reduce energy use.

CONDITIONS WHERE PRACTICE APPLIES

This practice is applicable to all irrigated lands.

An irrigation system adapted for site conditions (soil, slope, crop grown, climate, water quantity and quality, air quality, etc.) must be available and capable of efficiently applying water to meet the intended purpose(s).

CRITERIA

General Criteria Applicable to All Purposes

Irrigation water shall be applied in accordance with federal, state, and local rules, laws, and regulations. Water shall not be applied in excess of the needs to meet the intended purpose.

Measurement and determination of flow rate is a critical component of irrigation water management and shall be a part of all irrigation water management purposes.

The irrigator or decision-maker must possess the knowledge, skills, and capabilities of management coupled with a properly designed, efficient and functioning irrigation system to reasonably achieve the purposes of irrigation water management.

An “Irrigation Water Management Plan” shall be developed to assist the irrigator or decision-maker in the proper management and application of irrigation water.

Irrigator Skills and Capabilities. Proper irrigation scheduling, in both timing and amount, control of runoff, minimizing deep percolation, and the uniform application of water are of primary concern. The irrigator or decision-maker shall possess or obtain the knowledge and capability to accomplish the purposes which include:

A. General

1. How to determine when irrigation water should be applied, based on the rate of water used by crops and on the stages of plant growth and/or soil moisture monitoring.
2. How to determine the amount of water required for each irrigation, including any leaching needs.
3. How to recognize and control erosion caused by irrigation.
4. How to measure or determine the uniformity of application of an irrigation.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact your Natural Resources Conservation Service State Office, or download it from the electronic Field Office Technical Guide.

5. How to perform system maintenance to assure efficient operation.
6. Knowledge of "where the water goes" after it is applied considering soil surface and subsurface conditions, soil intake rates and permeability, crop root zones, and available water holding capacity.
7. How to manage salinity and shallow water tables through water management.
8. The capability to control the irrigation delivery.

B. Surface Systems

1. The relationship between advance rate, time of opportunity, intake rate, and other aspects of distribution uniformity and the amount of water infiltrated.
2. How to determine and control the amount of irrigation runoff.
3. How to adjust stream size, adjust irrigation time, or employ techniques such as "surge irrigation" to compensate for seasonal changes in intake rate or to improve efficiency of application.

C. Subsurface Systems

1. How to balance the relationship between water tables, leaching needs, and irrigation water requirements.
2. The relationship between the location of the subsurface system to normal farming operations.
3. How to locate and space the system to achieve uniformity of water application.
4. How to accomplish crop germination in arid climates and during dry periods.

D. Pressurized Systems

1. How to adjust the application rate and/or duration to apply the required amount of water.
2. How to recognize and control runoff.
3. How to identify and improve uniformity of water application.
4. How to account for surface storage due to residue and field slope in situations where sprinkler application rate exceeds soil intake rate.
5. How to identify and manage for weather conditions that adversely impact irrigation efficiency and uniformity of application.

System Capability. The irrigation system must be capable of applying water uniformly and efficiently and must provide the irrigator with adequate control over water application.

Additional Criteria to Manage Soil Moisture to Promote Desired Crop Response

The following principles shall be applied for various crop growth stages:

- The volume of water needed for each irrigation shall be based on plant available water-holding capacity of the soil for the crop rooting depth, management allowed soil water depletion, irrigation efficiency and water table contribution.
- The irrigation frequency shall be based on the volume of irrigation water needed and/or available to the crop, the rate of crop evapotranspiration, and effective precipitation.
- The application rate shall be based on the volume of water to be applied, the frequency of irrigation applications, soil infiltration and permeability characteristics, and the capacity of the irrigation system.

Appropriate field adjustments shall be made for seasonal variations and field variability.

Additional Criteria to Optimize Use of Water Supplies

Limited irrigation water supplies shall be managed to meet critical crop growth stages.

When water supplies are estimated to be insufficient to meet even the critical crop growth stage, the irrigator or decision-maker shall modify plant populations, crop and variety selection, and/or irrigated acres to match available or anticipated water supplies.

Additional Criteria to Minimize Irrigation-Induced Soil Erosion

Application rates shall be consistent with local field conditions for long-term productivity of the soil.

Additional Criteria to Decrease Non-Point Source Pollution of Surface and Groundwater Resources

Water application shall be at rates that minimize transport of sediment, nutrients and chemicals to surface waters and that minimize transport of nutrients and chemicals to groundwater.

Additional Criteria to Manage Salts in the Crop Root Zone

The irrigation application volume shall be increased by the amount required to maintain an appropriate salt balance in the soil profile.

The requirement shall be based on the leaching procedure contained in NRCS National Engineering Handbook (NEH), Part 623, Chapter 2, Irrigation Water Requirements, and NEH, Part 652, National Irrigation Guide, Chapters 3 and 13.

Additional Criteria to Manage Air, Soil or Plant Micro-Climate

The irrigation system shall have the capacity to apply the required rate of water for cold or heat protection as determined by the methodology contained in NEH, Part 623, Chapter 2, Irrigation Water Requirements.

Additional Criteria for Proper and Safe Chemigation or Fertigation

Chemigation or fertigation shall be done in accordance with all local, state and federal laws.

The scheduling of nutrient and chemical application should coincide with the irrigation cycle in a manner that will not cause excess leaching of nutrients or chemicals below the root zone to the groundwater or to cause excess runoff to surface waters.

Chemigation or fertigation should not be applied if rainfall is imminent. Application of chemicals or nutrients will be limited to the minimum length of time required to deliver them and flush the pipelines. Irrigation application amount shall be limited to the amount necessary to apply the chemicals or nutrients to the soil depth recommended by label. The timing and rate of application shall be based on the pest, herbicide, or nutrient management plan.

The irrigation and delivery system shall be equipped with properly designed and operating valves and components to prevent backflows into the water source(s) and/or contamination of groundwater, surface water, or the soil.

Additional Criteria to Reduce Particulate Matter Movement

Sprinkler irrigation water shall be applied at a rate and frequency sufficient to reduce the wind erodibility index (I Factor) of the soil by one class.

Additional Criteria Applicable to Reduce Energy Use

Provide analysis to demonstrate reduction of energy use from practice implementation.

Reduction of energy use is calculated as average annual or seasonal energy reduction compared to previous operating conditions.

CONSIDERATIONS

The following items should be considered when planning irrigation water management:

- Consideration should be given to managing precipitation effectiveness, crop residues, and reducing system losses.
- Consider potential for spray drift and odors when applying agricultural and municipal waste waters. Timing of irrigation should be based on prevailing winds to reduce odor. In areas of high visibility, irrigating at night should be considered.
- Consider potential for overspray from end guns onto public roads.
- Equipment modifications and/or soil amendments such as polyacrylamides and mulches should be considered to decrease erosion.
- Consider the quality of water and the potential impact to crop quality and plant development.
- Quality of irrigation water should be considered relative to its potential effect on the soil's physical and chemical properties, such as soil crusting, pH, permeability, salinity, and structure.
- Avoid traffic on wet soils to minimize soil compaction.
- Consider the effects that irrigation water has on wetlands, water related wildlife

habitats, riparian areas, cultural resources, and recreation opportunities.

- Management of nutrients and pesticides.
- Schedule salt leaching events to coincide with low residual soil nutrients and pesticides.
- Water should be managed in such a manner as to not drift or come in direct contact with surrounding electrical lines, supplies, devices, controls, or components that would cause shorts in the same or the creation of an electrical safety hazard to humans or animals.
- Consideration should be given to electrical load control/interruptible power schedules, repair and maintenance downtime, and harvest downtime.
- Consider improving the irrigation system to increase distribution uniformity or application efficiency of irrigation water applications.

PLANS AND SPECIFICATIONS

Application of this standard may include job sheets or similar documents that specify the applicable requirements, system operations, and components necessary for applying and maintaining the practice to achieve its intended purpose(s).

OPERATION AND MAINTENANCE

The operation and maintenance (O&M) aspects applicable to this standard consist of evaluating available field soil moisture, changes in crop evapotranspiration rates and changes in soil intake rates and adjusting the volume, application rate, or frequency of water application to achieve the intended purpose(s). Other necessary O&M items are addressed in the physical component standards considered companions to this standard.

REFERENCES

USDA-NRCS, National Engineering Handbook, Part 623, Chapter 2, Irrigation Water Requirements.

USDA-NRCS, National Engineering Handbook, Part 652, National Irrigation Guide.

NUTRIENT MANAGEMENT

PRACTICE INTRODUCTION

USDA, Natural Resources Conservation Service - practice code 590

NUTRIENT MANAGEMENT
This practice involves managing the amount, placement, and timing of plant nutrients to obtain optimum yields and minimize the risk of surface and groundwater pollution.

PRACTICE INFORMATION
Nutrient management may be used on any area of land where plant nutrients are applied to enhance yields and maintain or improve chemical and biological condition of the soil. The source of plant nutrients may be from organic wastes, commercial fertilizer, legumes, or crop residue. The objective is to apply the proper amount of nutrients at the proper time to achieve the desired yield and minimize entry of nutrients into surface or groundwater supplies.

Planning Nutrient Management involves the following considerations:

1. National, state and local water quality standards
2. Sources and forms of plant nutrients available to the farmer
3. Amounts and timing of nutrients based on soil testing, planned yield and growing season of target plants
4. Evaluate use of crop rotations that enhance efficiency of nutrient utilization and improve soil tilth
5. Consider waste storage requirements and land area requirements for proper management of plant nutrients.
6. Others

Additional information including standards and specifications are filed in the local NRCS Field Office Technical Guide.

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

NUTRIENT MANAGEMENT

(Ac.)

CODE 590

DEFINITION

Managing the amount (rate), source, placement (method of application), and timing of plant nutrients and soil amendments.

PURPOSE

- To budget, supply, and conserve nutrients for plant production.
- To minimize agricultural nonpoint source pollution of surface and groundwater resources.
- To properly utilize manure or organic by-products as a plant nutrient source.
- To protect air quality by reducing odors, nitrogen emissions (ammonia, oxides of nitrogen), and the formation of atmospheric particulates.
- To maintain or improve the physical, chemical, and biological condition of soil.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all lands where plant nutrients and soil amendments are applied. This standard does not apply to one-time nutrient applications to establish perennial crops.

CRITERIA

General Criteria Applicable to All Purposes

A nutrient budget for nitrogen, phosphorus, and potassium must be developed that considers all potential sources of nutrients including, but not limited to, green manures, legumes, crop residues, compost, animal manure, organic by-products, biosolids, waste water, organic matter, soil biological activity, commercial fertilizer, and irrigation water.

Enhanced efficiency fertilizers, used in the State must be defined by the Association of American Plant Food Control Officials (AAPFCO) and be accepted for use by the State fertilizer control official, or similar authority, with responsibility for verification of product guarantees, ingredients (by AAPFCO definition) and label claims.

For nutrient risk assessment policy and procedures see Title 190, General Manual (GM), Part 402, Nutrient Management, and Title 190, National Instruction (NI), Part 302, Nutrient Management Policy Implementation.

To avoid salt damage, the rate and placement of applied nitrogen and potassium in starter fertilizer must be consistent with land-grant university guidelines, or industry practice recognized by the land-grant university.

The NRCS-approved nutrient risk assessment for nitrogen must be completed on all sites unless the State NRCS, with the concurrence of State water quality control authorities, has determined specific conditions where nitrogen leaching is not a risk to water quality, including drinking water.

The NRCS-approved nutrient risk assessment for phosphorus must be completed when:

- phosphorus application rate exceeds land-grant university fertility rate guidelines for the planned crop(s), or
- the planned area is within a phosphorus- impaired watershed (contributes to 303d-listed water bodies), or
- the NRCS and State water quality control authority have not determined specific conditions where the risk of phosphorus loss is low.

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact your Natural Resources Conservation Service State Office or visit the Field Office Technical Guide.

A phosphorus risk assessment will not be required when the State NRCS, with concurrence of the State water quality control authority, has determined specific conditions where the risk of phosphorus loss is low. These fields must have a documented agronomic need for phosphorus; based on soil test phosphorus (STP) and land-grant university nutrient recommendations.

On organic operations, the nutrient sources and management must be consistent with the USDA's National Organic Program.

Areas contained within minimum application setbacks (e.g., sinkholes, wellheads, gullies, ditches, or surface inlets) must receive nutrients consistent with the setback restrictions.

Applications of irrigation water must minimize the risk of nutrient loss to surface and groundwater.

Soil pH must be maintained in a range that enhances an adequate level for crop nutrient availability and utilization. Refer to State land-grant university documentation for guidance.

Soil, Manure, and Tissue Sampling and Laboratory Analyses (Testing).

Nutrient planning must be based on current soil, manure, and (where used as supplemental information) tissue test results developed in accordance with land-grant university guidance, or industry practice, if recognized by the university.

Current soil tests are those that are no older than 3 years, but may be taken on an interval recommended by the land-grant university or as required by State code. The area represented by a soil test must be that acreage recommended by the land-grant university.

Where a conservation management unit (CMU) is used as the basis for a sampling unit, all acreage in the CMU must have similar soil type, cropping history, and management practice treatment.

The soil and tissue tests must include analyses pertinent to monitoring or amending the annual nutrient budget, e.g., pH, electrical conductivity (EC) and sodicity where salts are a concern, soil organic matter, phosphorus, potassium, or other nutrients and test for nitrogen where applicable. Follow land-grant university guidelines regarding required analyses.

Soil test analyses must be performed by laboratories successfully meeting the requirements and performance standards of the North American Proficiency Testing Program-Performance Assessment Program (NAPT-PAP) under the auspices of the Soil Science Society of America (SSSA) and NRCS, or other NRCS-approved program that considers laboratory performance and proficiency to assure accuracy of soil test results. Alternate proficiency testing programs must have solid stakeholder (e.g., water quality control entity, NRCS State staff, growers, and others) support and be regional in scope.

Nutrient values of manure, organic by-products and biosolids must be determined prior to land application.

Manure analyses must include, at minimum, total nitrogen (N), ammonium N, total phosphorus (P) or P_2O_5, total potassium (K) or K_2O, and percent solids, or follow land-grant university guidance regarding required analyses.

Manure, organic by-products, and biosolids samples must be collected and analyzed at least annually, or more frequently if needed to account for operational changes (feed management, animal type, manure handling strategy, etc.) impacting manure nutrient concentrations. If no operational changes occur, less frequent manure testing is allowable where operations can document a stable level of nutrient concentrations for the preceding three consecutive years, unless federal, State, or local regulations require more frequent testing.

Samples must be collected, prepared, stored, and shipped, following land-grant university guidance or industry practice.

When planning for new or modified livestock operations, acceptable "book values" recognized by the NRCS (e.g., NRCS Agricultural Waste Management Field Handbook) and the land-grant university, or analyses from similar operations in the geographical area, may be used if they accurately estimate nutrient output from the proposed operation.

Manure testing analyses must be performed by laboratories successfully meeting the requirements and performance standards of the Manure Testing Laboratory Certification program (MTLCP) under the auspices of the Minnesota Department of Agriculture, or other NRCS-approved program that considers laboratory performance and proficiency to assure accurate manure test results.

Nutrient Application Rates.

Planned nutrient application rates for nitrogen, phosphorus, and potassium must not exceed land-grant university guidelines or industry practice when recognized by the university.

At a minimum, determination of rate must be based on crop/cropping sequence, current soil test results, realistic yield goals, and NRCS-approved nutrient risk assessments.

If the land-grant university does not provide specific guidance that meets these criteria, application rates must be based on plans that consider realistic yield goals and associated plant nutrient uptake rates.

Realistic yield goals must be established based on historical yield data, soil productivity information, climatic conditions, nutrient test results, level of management, and local research results considering comparable production conditions.

Estimates of yield response must consider factors such as poor soil quality, drainage, pH, salinity, etc., prior to assuming that nitrogen and/or phosphorus are deficient.

For new crops or varieties, industry-demonstrated yield, and nutrient utilization information may be used until land-grant university information is available.

Lower-than-recommended nutrient application rates are permissible if the grower's objectives are met.

Applications of biosolids, starter fertilizers, or pop-up fertilizers must be accounted for in the nutrient budget.

Nutrient Sources.

Nutrient sources utilized must be compatible with the application timing, tillage and planting system, soil properties, crop, crop rotation, soil organic content, and local climate to minimize risk to the environment.

Nutrient Application Timing and Placement.

Timing and placement of all nutrients must correspond as closely as practical with plant nutrient uptake (utilization by crops), and consider nutrient source, cropping system limitations, soil properties, weather conditions, drainage system, soil biology, and nutrient risk assessment results.

Nutrients must not be surface-applied if nutrient losses offsite are likely. This precludes spreading on:

- frozen and/or snow-covered soils, and
- when the top 2 inches of soil are saturated from rainfall or snow melt.

Exceptions for the above criteria can be made for surface-applied manure when specified conditions are met and adequate conservation measures are installed to prevent the offsite delivery of nutrients. The adequate treatment level and specified conditions for winter applications of manure must be defined by NRCS in concurrence with the water quality control authority in the State. At a minimum, the following site and management factors must be considered:

- slope,
- organic residue and living covers,
- amount and form of nutrients to be applied, and
- adequate setback distances to protect local water quality.

Additional Criteria to Minimize Agricultural Nonpoint Source Pollution of Surface and Groundwater

Planners must use the current NRCS-approved nitrogen, phosphorus, and soil erosion risk assessment tools to assess the risk of nutrient and soil loss. Identified resource concerns must be addressed to meet current planning criteria (quality criteria). Technical criteria for risk assessments can be found in NI-190-302.

When there is a high risk of transport of nutrients, conservation practices must be coordinated to avoid, control, or trap manure and nutrients before they can leave the field by surface or subsurface drainage (e.g., tile). The number of applications and the application rates must also be considered to limit the transport of nutrients to tile.

Nutrients must be applied with the right placement, in the right amount, at the right time, and from the right source to minimize nutrient losses to surface and groundwater. The following nutrient use efficiency strategies or technologies must be considered:

- slow and controlled release fertilizers
- nitrification and urease inhibitors
- enhanced efficiency fertilizers
- incorporation or injection
- timing and number of applications
- soil nitrate and organic N testing
- coordinate nutrient applications with optimum crop nutrient uptake
- Corn Stalk Nitrate Test (CSNT), Pre-Sidedress Nitrate Test (PSNT), and Pre-Plant Soil Nitrate Test (PPSN)
- tissue testing, chlorophyll meters, and spectral analysis technologies
- other land-grant university recommended technologies that improve nutrient use efficiency and minimize surface or groundwater resource concerns.

Additional Criteria Applicable to Properly Utilize Manure or Organic By-Products as a Plant Nutrient Source

When manures are applied, and soil salinity is a concern, salt concentrations must be monitored to prevent potential crop damage and/or reduced soil quality.

The total single application of liquid manure:

- must not exceed the soil's infiltration or water holding capacity
- be based on crop rooting depth
- must be adjusted to avoid runoff or loss to subsurface tile drains.

Crop production activities and nutrient use efficiency technologies must be coordinated to take advantage of mineralized plant-available nitrogen to minimize the potential for nitrogen losses due to denitrification or ammonia volatilization.

Nitrogen and phosphorus application rates must be planned based on risk assessment results as determined by NRCS-approved nitrogen and phosphorus risk assessment tools.

For fields receiving manure, where phosphorus risk assessment results equate to LOW risk, additional phosphorus and potassium can be applied at rates greater than crop requirement not to exceed the nitrogen requirement for the succeeding crop. For fields receiving manure, where phosphorus risk assessment results equate to MODERATE risk, additional phosphorus and potassium may be applied at a phosphorus crop requirement rate for the planned crops in the rotation. When phosphorus risk assessment results equate to HIGH risk, additional phosphorus and potassium may be applied at phosphorus crop removal rates if the following requirements are met:

- a soil phosphorus drawdown strategy has been implemented, and
- a site assessment for nutrients and soil loss has been conducted to determine if mitigation practices are required to protect water quality.
- any deviation from these high risk requirements must have the approval of the Chief of the NRCS.

Manure or organic by-products may be applied on legumes at rates equal to the estimated removal of nitrogen in harvested plant biomass, not to exceed land grant university recommendations.

Manure may be applied at a rate equal to the recommended phosphorus application, or estimated phosphorus removal in harvested plant biomass for the crop rotation, or multiple years in the crop sequence at one time. When such applications are made, the application rate must not exceed the acceptable phosphorus risk assessment criteria, must not exceed the recommended nitrogen application rate during the year of application or harvest cycle, and no additional phosphorus must be applied in the current year and any additional years for which the single application of phosphorus is supplying nutrients.

Additional Criteria to Protect Air Quality by Reducing Odors, Nitrogen Emissions and the Formation of Atmospheric Particulates

To address air quality concerns caused by odor, nitrogen, sulfur, and/or particulate emissions; the source, timing, amount, and placement of nutrients must be adjusted to minimize the negative impact of these emissions on the environment and human health. One or more of the following may be used:

- slow or controlled release fertilizers
- nitrification inhibitors
- urease inhibitors
- nutrient enhancement technologies
- incorporation
- injection
- stabilized nitrogen fertilizers
- residue and tillage management
- no-till or strip-till
- other technologies that minimize the impact of these emissions

Do not apply poultry litter, manure, or organic by-products of similar dryness/density when there is a high probability that wind will blow the material offsite.

Additional Criteria to Improve or Maintain the Physical, Chemical, and Biological Condition of the Soil to Enhance Soil Quality for Crop Production and Environmental Protection

Time the application of nutrients to avoid periods when field activities will result in soil compaction.

In areas where salinity is a concern, select nutrient sources that minimize the buildup of soil salts.

CONSIDERATIONS

Elevated soil test phosphorus levels are detrimental to soil biota. Soil test phosphorus levels should not exceed State-approved soil test thresholds established to protect the environment.

Use no-till/strip-till in combination with cover crops to sequester nutrients, increase soil organic matter, increase aggregate stability, reduce compaction, improve infiltration, and enhance soil biological activity to improve nutrient use efficiency.

Use nutrient management strategies such as cover crops, crop rotations, and crop rotations with perennials to improve nutrient cycling and reduce energy inputs.

Use variable-rate nitrogen application based on expected crop yields, soil variability, soil nitrate or organic N supply levels, or chlorophyll concentration.

Use variable-rate nitrogen, phosphorus, and potassium application rates based on site-specific variability in crop yield, soil characteristics, soil test values, and other soil productivity factors.

Develop site-specific yield maps using a yield monitoring system. Use the data to further diagnose low- and high- yield areas, or zones, and make the necessary management changes. See Title 190, Agronomy Technical Note (TN) 190.AGR.3, Precision Nutrient Management Planning.

Use manure management conservation practices to manage manure nutrients to limit losses prior to nutrient utilization.

Apply manure at a rate that will result in an “improving” Soil Conditioning Index (SCI) without exceeding acceptable risk of nitrogen or phosphorus loss.

Use legume crops and cover crops to provide nitrogen through biological fixation and nutrient recycling.

Modify animal feed diets to reduce the nutrient content of manure following guidance contained in Conservation Practice Standard (CPS) Code 592, Feed Management.

Soil test information should be no older than 1 year when developing new plans.

Excessive levels of some nutrients can cause induced deficiencies of other nutrients, e.g., high soil test phosphorus levels can result in zinc deficiency in corn.

Use soil tests, plant tissue analyses, and field observations to check for secondary plant nutrient deficiencies or toxicity that may impact plant growth or availability of the primary nutrients.

Use the adaptive nutrient management learning process to improve nutrient use efficiency on farms as outlined in the NRCS’ National Nutrient Policy in GM 190, Part 402, Nutrient Management.

Potassium should not be applied in situations where an excess (greater than soil test potassium recommendation) causes nutrient imbalances in crops or forages.

Workers should be protected from and avoid unnecessary contact with plant nutrient sources. Extra caution must be taken when handling anhydrous ammonia or when dealing with organic wastes stored in unventilated enclosures.

Material generated from cleaning nutrient application equipment should be utilized in an environmentally safe manner. Excess material should be collected and stored or field applied in an appropriate manner.

Nutrient containers should be recycled in compliance with State and local guidelines or regulations.

Considerations to Minimize Agricultural Nonpoint Source Pollution of Surface and Groundwater.

Use conservation practices that slow runoff, reduce erosion, and increase infiltration, e.g., filter strip, contour farming, or contour buffer strips. These practices can also reduce the loss of nitrates or soluble phosphorus.

Use application methods and timing strategies that reduce the risk of nutrient transport by ground and surface waters, such as:

- split applications of nitrogen to deliver nutrients during periods of maximum crop utilization,
- banded applications of nitrogen and/or phosphorus to improve nutrient availability,
- drainage water management to reduce nutrient discharge through drainage systems, and
- incorporation of surface-applied manures or organic by-products if precipitation capable of producing runoff or erosion is forecast within the time of planned application.

Use the agricultural chemical storage facility conservation practice to protect air, soil, and water quality.

Use bioreactors and multistage drainage strategies when approved by the land-grant university.

Considerations to Protect Air Quality by Reducing Nitrogen and/or Particulate Emissions to the Atmosphere.

Avoid applying manure and other by-products upwind of inhabited areas.

Use high-efficiency irrigation technologies (e.g., reduced-pressure drop nozzles for center pivots) to reduce the potential for nutrient losses.

PLANS AND SPECIFICATIONS

The following components must be included in the nutrient management plan:

- aerial site photograph(s)/imagery or site map(s), and a soil survey map of the site,
- soil information including: soil type surface texture, pH, drainage class, permeability, available water capacity, depth to water table, restrictive features, and flooding and/or ponding frequency,
- location of designated sensitive areas and the associated nutrient application restrictions and setbacks,
- for manure applications, location of nearby residences, or other locations where humans may be present on a regular basis, and any identified meteorological (e.g., prevailing winds at different times of the year), or topographical influences that may affect the transport of odors to those locations,
- results of approved risk assessment tools for nitrogen, phosphorus, and erosion losses,
- documentation establishing that the application site presents low risk for phosphorus transport to local water when phosphorus is applied in excess of crop requirement.
- current and/or planned plant production sequence or crop rotation,
- soil, water, compost, manure, organic by-product, and plant tissue sample analyses applicable to the plan,
- when soil phosphorus levels are increasing, include a discussion of the risk associated with phosphorus accumulation and a proposed phosphorus draw-down strategy,
- realistic yield goals for the crops,
- complete nutrient budget for nitrogen, phosphorus, and potassium for the plant production sequence or crop rotation,
- listing and quantification of all nutrient sources and form,

- all enhanced efficiency fertilizer products that are planned for use,
- in accordance with the nitrogen and phosphorus risk assessment tool(s), specify the recommended nutrient application source, timing, amount (except for precision/variable rate applications specify method used to determine rate), and placement of plant nutrients for each field or management unit, and
- guidance for implementation, operation and maintenance, and recordkeeping.

In addition, the following components must be included in a precision/variable rate nutrient management plan:

- Document the geo-referenced field boundary and data collected that was processed and analyzed as a GIS layer or layers to generate nutrient or soil amendment recommendations.
- Document the nutrient recommendation guidance and recommendation equations used to convert the GIS base data layer or layers to a nutrient source material recommendation GIS layer or layers.
- Document if a variable rate nutrient or soil amendment application was made.
- Provide application records per management zone or as applied map within individual field boundaries (or electronic records) documenting source, timing, method, and rate of all applications that resulted from use of the precision agriculture process for nutrient or soil amendment applications.
- Maintain the electronic records of the GIS data layers and nutrient applications for at least 5 years.

If increases in soil phosphorus levels are expected (i.e., when N-based rates are used), the nutrient management plan must document:

- the soil phosphorus levels at which it is desirable to convert to phosphorus based planning,
- the potential plan for soil test phosphorus drawdown from the production and harvesting of crops, and
- management activities or techniques used to reduce the potential for phosphorus transport and loss,
- for AFOs, a quantification of manure produced in excess of crop nutrient requirements, and
- a long-term strategy and proposed implementation timeline for reducing soil P to levels that protect water quality,

OPERATION AND MAINTENANCE

Conduct periodic plan reviews to determine if adjustments or modifications to the plan are needed. At a minimum, plans must be reviewed and revised, as needed with each soil test cycle, changes in manure volume or analysis, crops, or crop management.

Fields receiving animal manures and/or biosolids must be monitored for the accumulation of heavy metals and phosphorus in accordance with land- grant university guidance and State law.

Significant changes in animal numbers, management, and feed management will necessitate additional manure analyses to establish a revised average nutrient content.

Calibrate application equipment to ensure accurate distribution of material at planned rates.

Document the nutrient application rate. When the applied rate differs from the planned rate, provide appropriate documentation for the change.

Records must be maintained for at least 5 years to document plan implementation and maintenance. As applicable, records include:

- soil, plant tissue, water, manure, and organic by-product analyses resulting in recommendations for nutrient application,
- quantities, analyses and sources of nutrients applied,
- dates, and method(s) of nutrient applications, source of nutrients, and rates of application,

- weather conditions and soil moisture at the time of application; lapsed time to manure incorporation; rainfall or irrigation event,
- crops planted, planting and harvest dates, yields, nutrient analyses of harvested biomass, and crop residues removed,
- dates of plan review, name of reviewer, and recommended changes resulting from the review, and
- all enhanced efficiency fertilizer products used.

Additional records for precision/variable rate sites must include:

- maps identifying the variable application source, timing, amount, and placement of all plant nutrients applied, and
- GPS-based yield maps for crops where yields can be digitally collected.

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Exhibit 18

Successful on-farm practices to reduce water and fertilizer losses to groundwater

Presentation to the California State Water Board
SBX 2 1 Committee May 23, 2012

Bob Martin, General Manager,
Rio Farms, King City, CA

Drip Irrigation & Fertigation

- Onions need sprinkler + drip
- 4 lines/40” beds vs. 10 lines/80” beds
- Drip has less fertilizer and water lost due to
  - Wind erosion
  - Surface runoff
  - Leaching to groundwater
- Can result in higher quality crop due to more uniform applications
- Cannot use drip on every crop but it is useful tool

Drip: a growing trend in Monterey County

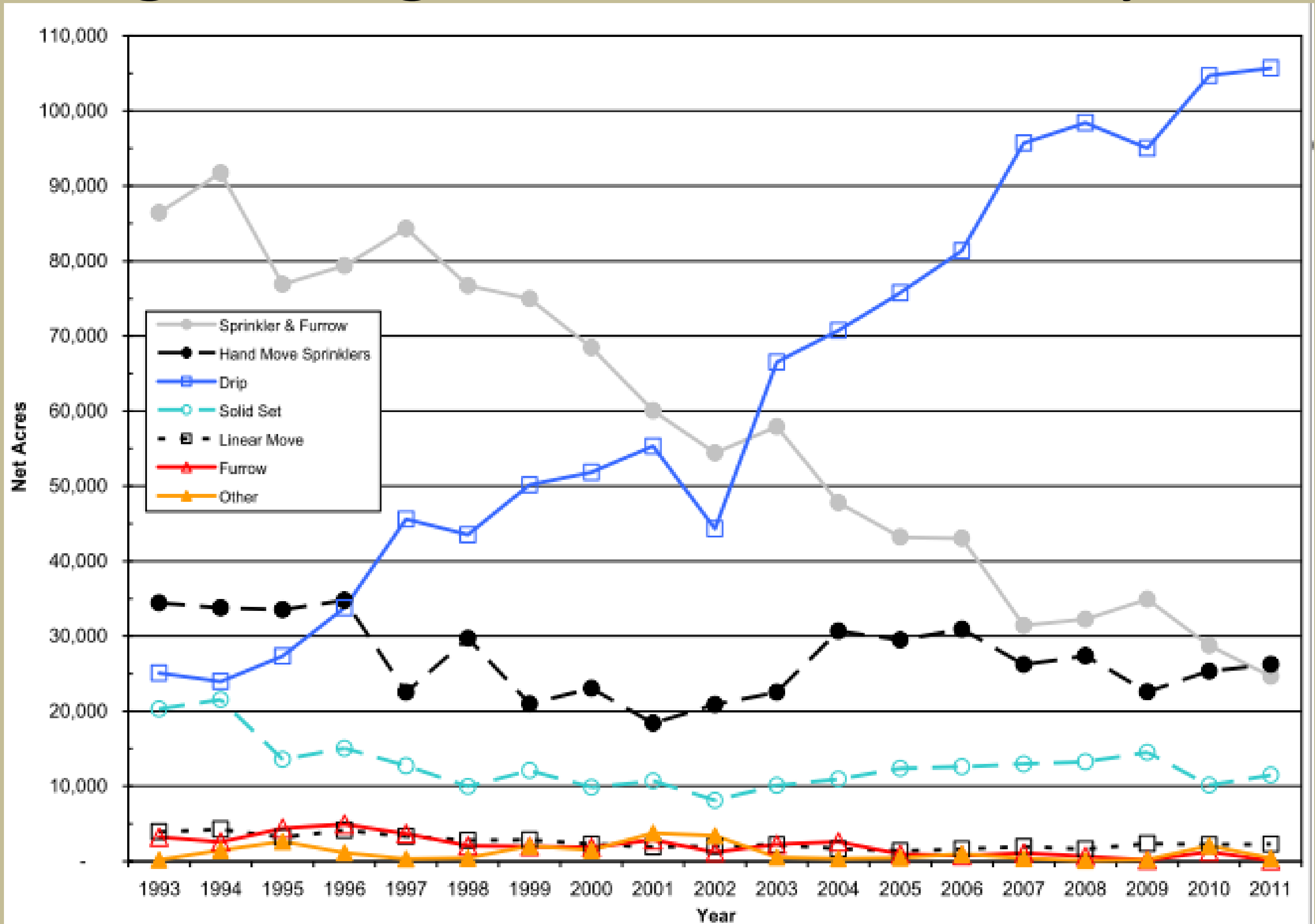


Figure 5. Types of irrigation methods used in the Salinas Valley based on companies reported

NOTE: Reported net acres vary from year to year

[Monterey Water Resources Agency, 2010 Report.](http://www.mcwra.co.monterey.ca.us/Agency_data/GEMS_Reports/2010%20Summary%20Report.pdf)
http://www.mcwra.co.monterey.ca.us/Agency_data/ GEMS_Reports/2010%20Summary%20Report.pdf

Split applications of fertilizer

- "Spoon feeding" of fertilizer at key growing periods
- Take the time to understand when your crop wants to be fed!

Nitrogen Fertilizer Requirements of Cool-Season Vegetable Crops Grown Under California Conditions[ii]

Crop	Approximate Nitrogen Requirements (lb/acre-week)			
Broccoli[1]	Early Growth 5-15[2]	Mid Season 10-20	Button Formation 15-30	Head Development 10-20
Cabbage	Early Growth 5	Mid Season 35	Curling 40	Heading 55
Celery	Early Growth 5	Mid Season 15	Late Season 25	
Garlic	Early Growth 5	Mid Season 10	Bulbing 15	
Lettuce[1]	Early Growth 5-10	Cupping 10-20	Head Filling 15-30	
Onion	Early Growth 5	Mid Season 15	Bulbing 10	

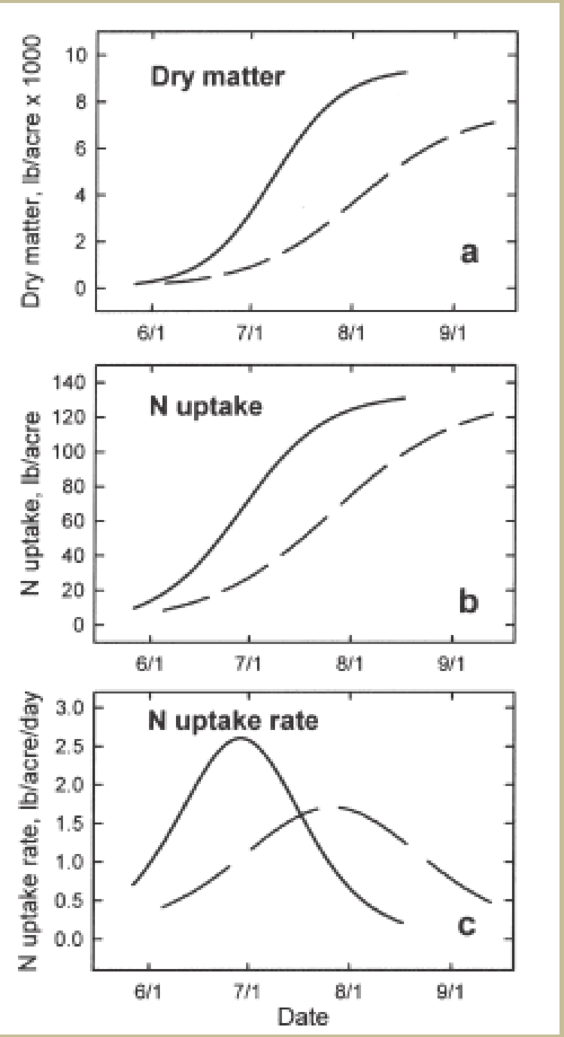
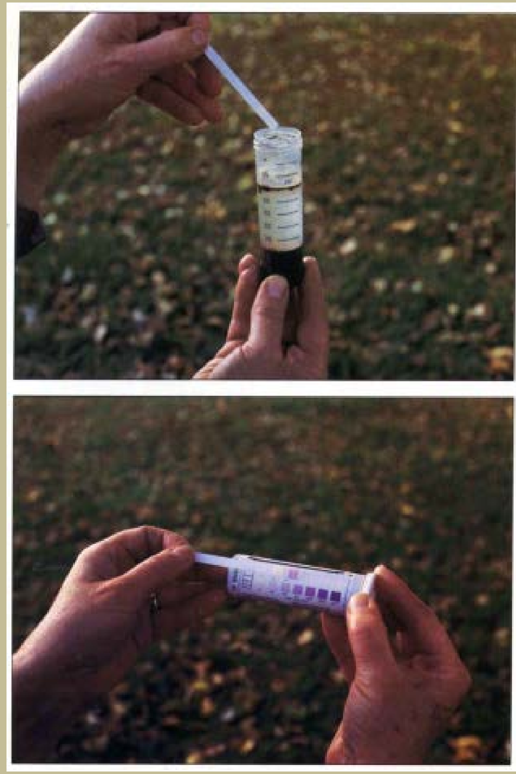


Table from: Monterey Water Resources Agency and Santa Clara Valley Water District. Using the Nitrate Present in Soil and Water in Your Fertilizer Calculations. Fact Sheet 4. http://www.pvwma.dst.ca.us/water_conservation_agr/assests/FactSheet%204-nitrate_fertilizer_calcs.pdf
Nutrient Graphs from : Brown, Brad. Southern Idaho Fertilizer Guide. University of Idaho Cooperative Extension System. CIS 1081. http://www.extension.uidaho.edu/nutrient/pdf/Specialty/OnionFertGuide.pdf

Composting

Quick Nitrate Soil Tests

- June-August testing, every year since 1997, over 300 samples
- Focus is between first and second crop
- Make & follow recommendation of fertilizer application
- Summer intern project



On-farm nitrogen tests improve fertilizer efficiency, protect groundwater

Timothy K. Hartz ❑ Richard F. Smith ❑ Kurt F. Schulbach ❑ Michelle LeStrange

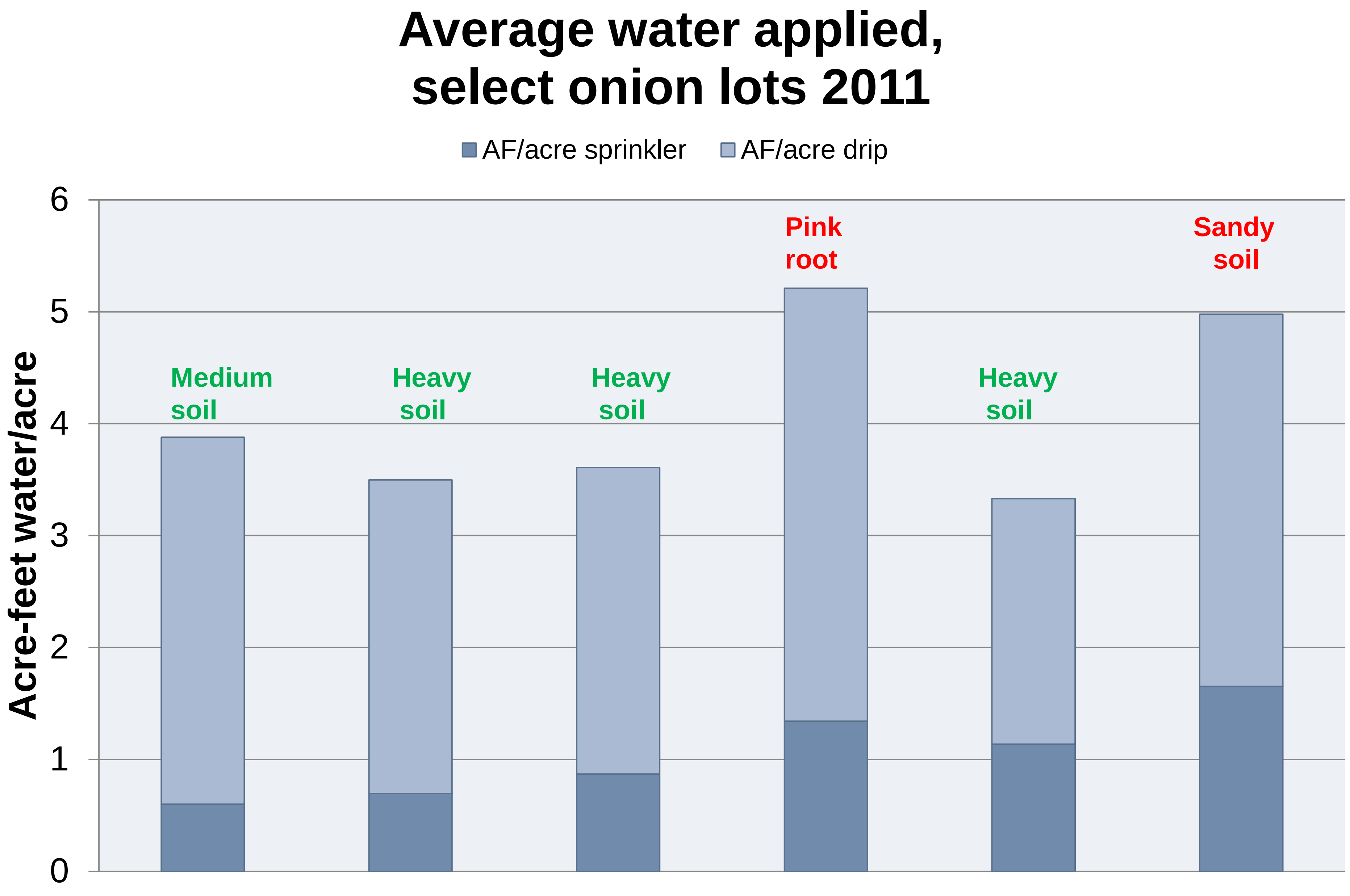
CALIFORNIA AGRICULTURE, JULY-AUGUST 1994 29

Water Meters

"You can't manage what you don't measure"

- Installed in 6 fields with different soils
- Brand: SeaMetrics AG 2000
- Investment (6 meters): $7,500

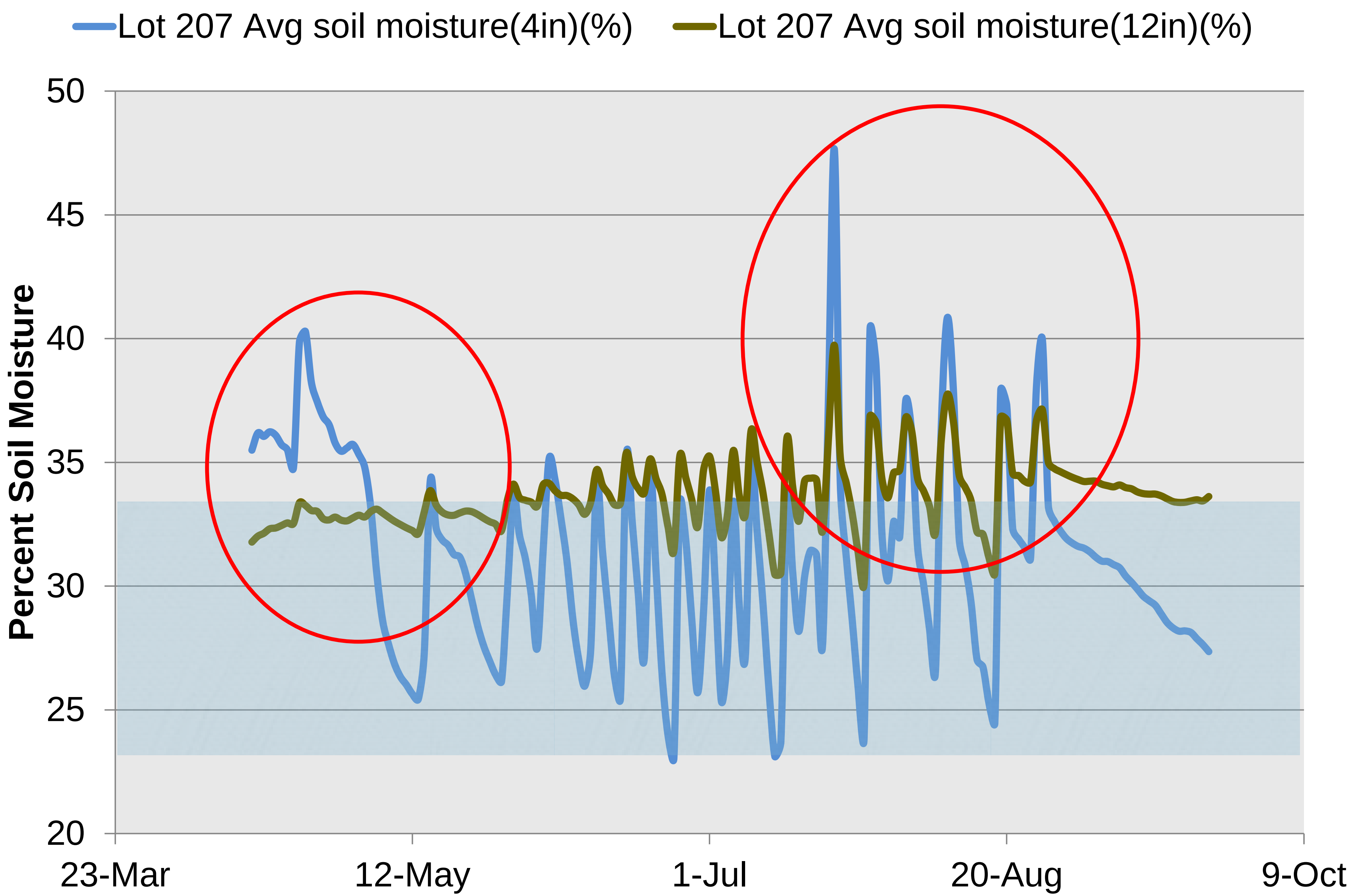
Water meter results



Soil Moisture Sensors

- 3 sensors + 1 base weather station (Solar Powered)
- 4 and 12 inch depths
- 2 inch soil temperature –bolting info
- Ideal moisture zone set based on science = soil test and crop characteristics
- Internet data access + automatic e-mails or text messages
- Pressure switch to give accurate # hours of irrigation
- Brands: Climate Minder (King City) and Pure Sense (other regions) used
- Investment (3 meters, 1 base): $11,000

Soil Moisture Sensor Results



Educational Partnerships

- Working with UC-Cooperative Extension, Resource Conservation District and other partners
- Irrigation Uniformity Testing (planned summer 2012)
- Water quality meetings and trainings
- Incorporating information in publications into growing practices

Conservation Connections
RESOURCE CONSERVATION DISTRICT OF MONTEREY COUNTY

UC CE University of California Cooperative Extension
Monterey County

Last thoughts

- Farmers know there is a water quality problem.
- Regulators should work towards solutions that fix the problem, not create expensive paperwork.
- Promote the obvious and easy fixes –irrigation efficiency and uniformity testing, split applications of fertilizer, other grower education
- Encourage the use of expensive technology such as soil moisture sensors through incentive programs, collective purchase agreements etc.
- Let’s encourage and fund research and grower assistance with people farmers respect – UCCE, RCDs etc.

Questions?

Bob Martin, Rio Farms
chilibob@RioFarms.com

Determination of nutrient uptake by strawberry

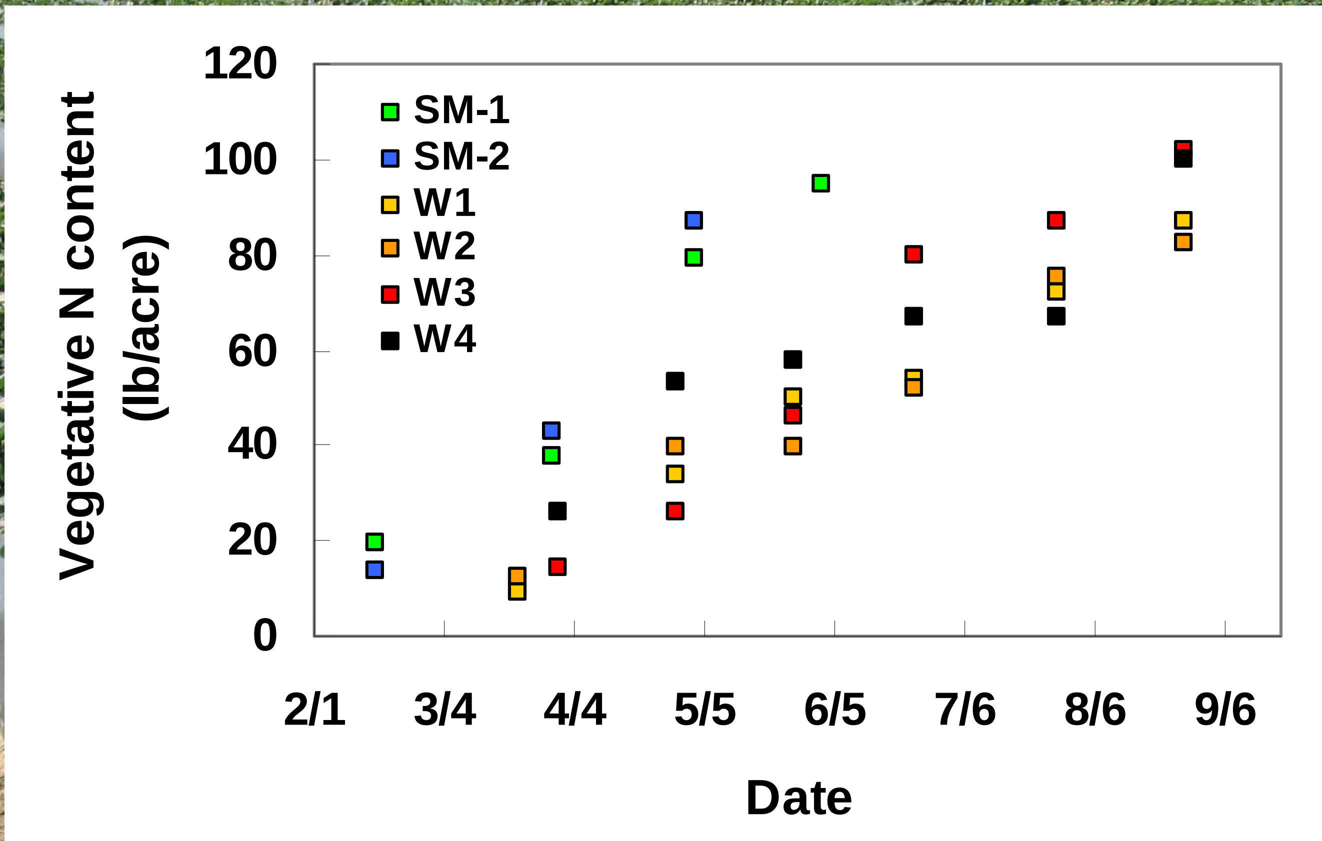
Exhibit 19

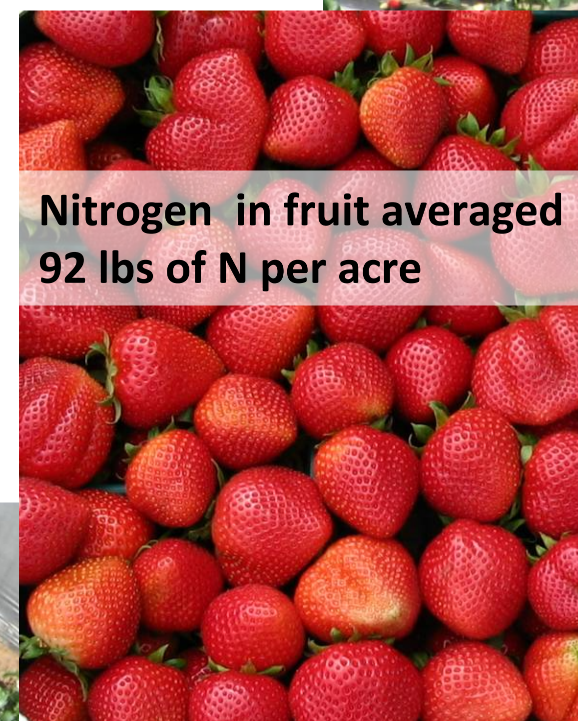
- monthly whole plant samples



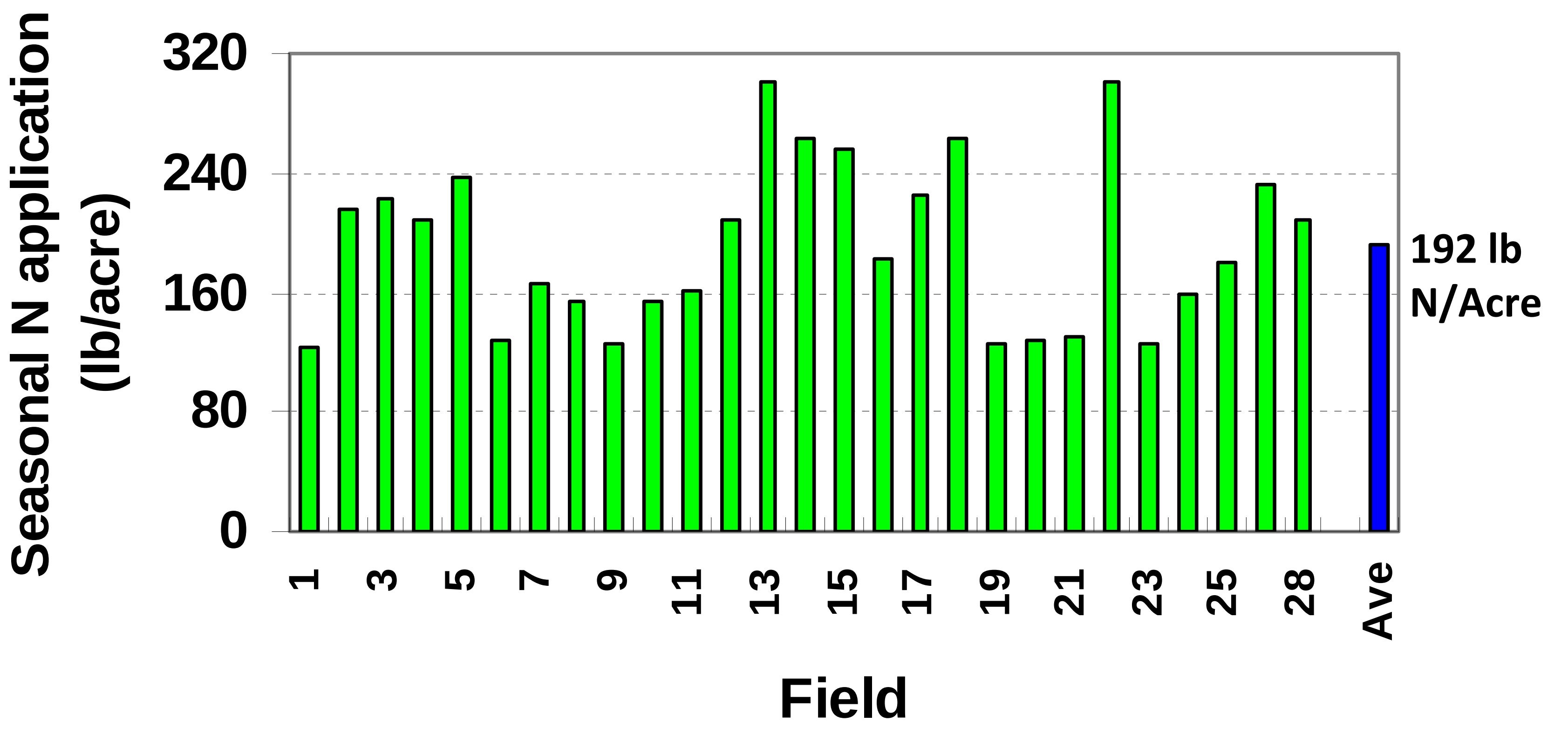
- plant and fruit measured separately

Average seasonal nitrogen uptake of strawberries: 200 lb N/acre

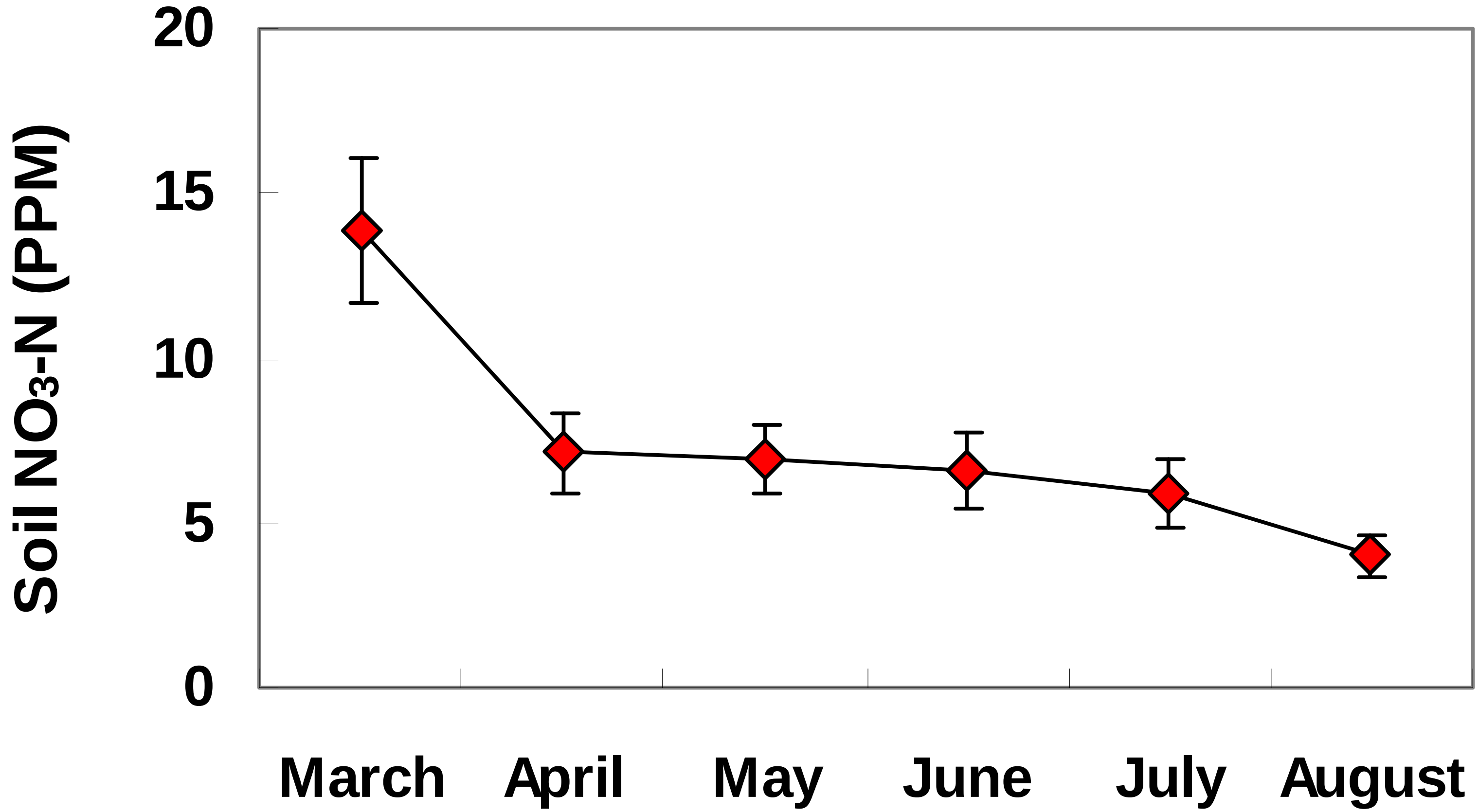




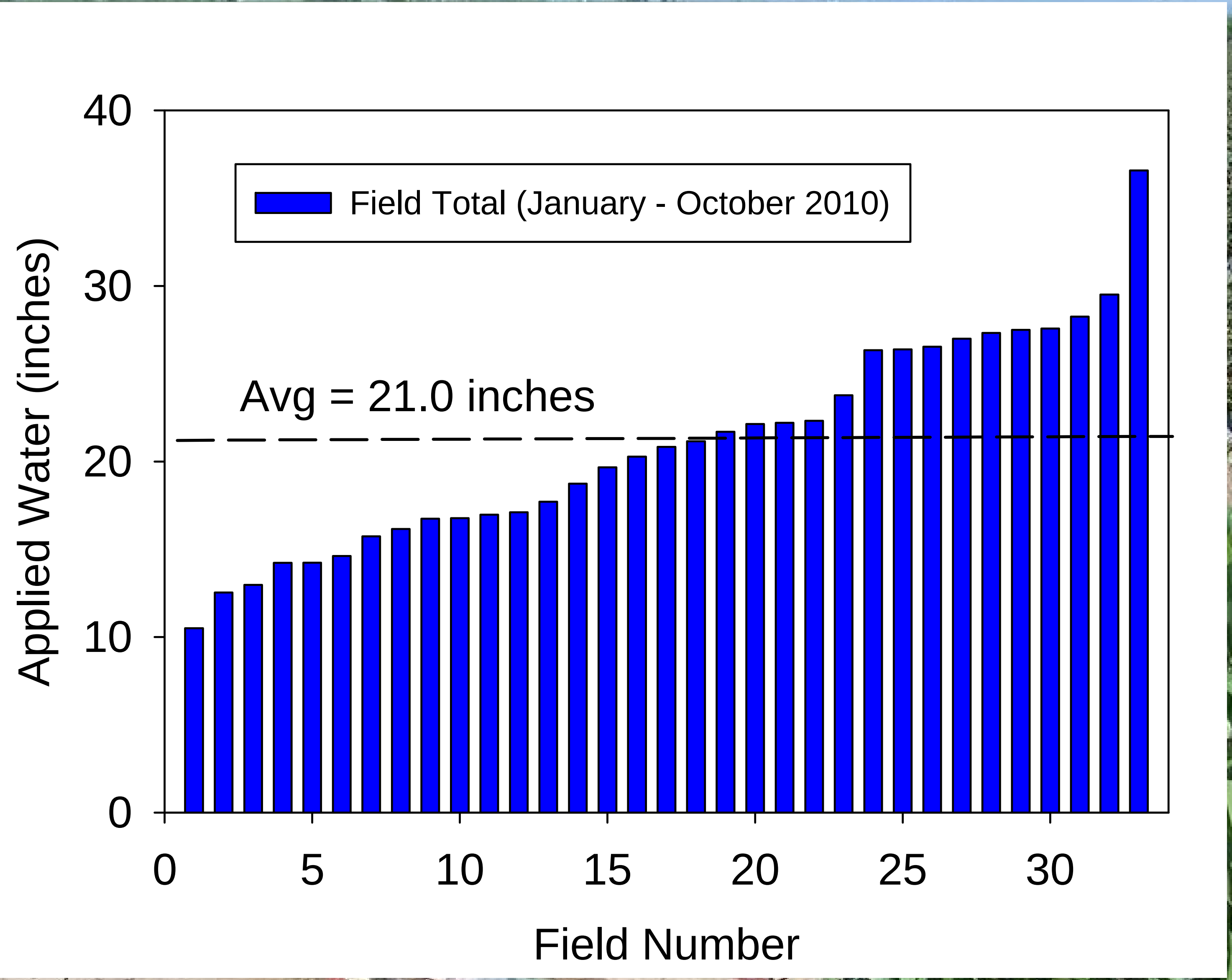
Average rate of N fertilizer applied to strawberries is currently below the 1.2 ratio



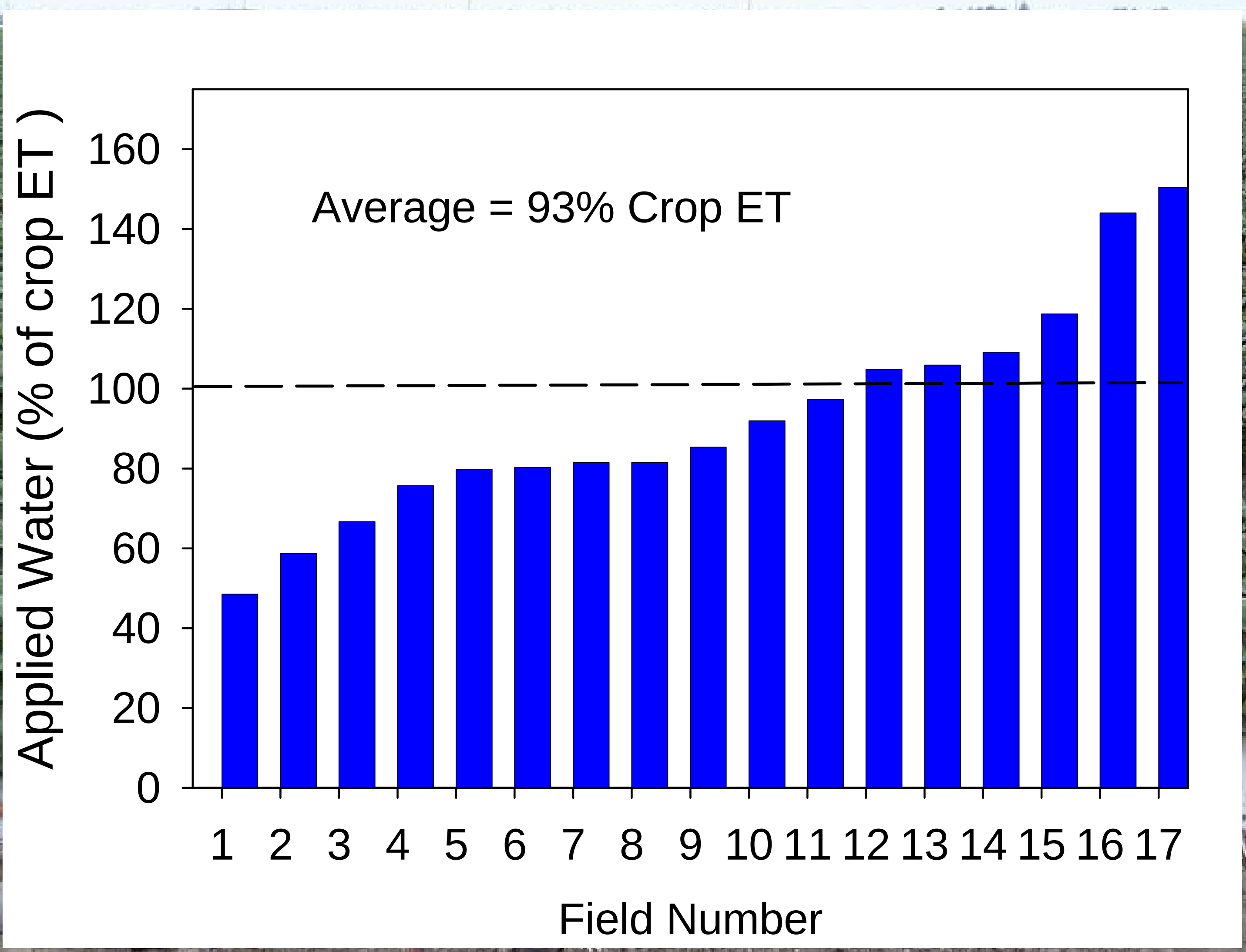
Average soil nitrate-N levels were < 10 ppm during the production season



Average seasonal applied water was 21 inches



Average amount of water applied to the crop was below crop ET requirement



Project Summary

1. Nitrogen uptake of strawberries and applied fertilizer N were in balance on a majority of fields

2. Average soil nitrate levels were < 10 ppm nitrate-N during the production season

3. Applied water volumes were in balance with crop ET requirements

4. Results indicated that a majority of strawberry acres are currently managed in a manner that minimizes nitrate leaching

Exhibit 20

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

WELL WATER TESTING

(No.)

CODE 355

DEFINITION

Testing for physical, biological, and chemical characteristics of groundwater in wells or spring developments.

PURPOSE

This practice may be applied as part of a conservation management system to determine the quality of a groundwater supply for the following intended uses: irrigation, livestock, fish and wildlife habitat, aquaculture enterprises, or other agricultural uses.

CONDITIONS WHERE PRACTICE APPLIES

This standard applies to water supplies that are used or have potential to be used on farms or ranches.

This practice does not apply to groundwater for human consumption, nor wells for monitoring groundwater hydrology or contamination associated with animal waste storage or treatment installations.

CRITERIA

The specific use of the water and the water quality concerns shall be identified.

The required tests and applicable standards shall be determined based on the planned use of the water.

Water samples shall be collected and analyzed in accordance with established procedures. Specific parameters, sampling procedures, and laboratory analyses may be specifically required by local, State, Tribal, or Federal laws and regulations. Contact the testing entity for specific guidance.

Interpretation of test results and recommendations for remedial actions, as necessary, shall be obtained from a source knowledgeable of the testing procedures and objectives.

CONSIDERATIONS

The following items should be considered in planning water supply testing:

- Location and depth of supply, aquifer characteristics, geology, and history of site in relationship to sources of potential contamination, such as surface water, septic systems, chemical storage facilities, landfills, roads, animal waste storage or treatment facilities, or naturally occurring sources of contamination
- Water supply construction practices used such as dug, drilled, or cased well, or spring development
- Using a computerized total farm record keeping system for ease of data input, analysis, and retrieval
- Using a State certified laboratory

PLANS AND SPECIFICATIONS

Plans and specifications for water testing shall be consistent with this standard to achieve the desired results.

Plans and specifications shall include a description of processes for collecting, storing, transporting, and testing samples; and reporting test results.

OPERATION AND MAINTENANCE

Water testing records that shall be maintained will include:

- Sample site, location, and depth
- Remotely-sensed or in-situ records of water quality conditions within the well (pH,

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard contact your Natural Resources Conservation Service State Office or download it from the Field Office Technical Guide for your state.

conductivity, turbidity, etc.)

- Date and time water sample taken
- Name and title of person who collected sample
- Type of sampler and sample taken
- Standard collection procedure followed
- Water test analysis date
- Laboratory performing the analysis
- Tested Contaminants
- Schedule of additional testing at required frequency according to applicable standard
- Records to evaluate trends and the effects of any remedial actions to produce water of sufficient quality for the intended purpose
- Rainfall data
- Observations on well condition
- Other records as required

Exhibit 21

DELLAVALLE®
Laboratory, Inc.
Chemists and Consultants

Well Water Testing & Reporting Requirements
Central Coast Regional Water Quality Control Board (Region 3)

The groundwater monitoring required by the Central Coast Regional Water Quality Control Board (RWQCB) includes analysis of well water samples plus use of the GeoTracker system to input data into the RWQCB database.

Required analysis: pH, specific conductance (EC), total dissolved solids, total alkalinity, calcium, magnesium, sodium, potassium, sulfate, chloride, nitrate and boron.*

*Although boron is not required and would not be submitted to Board, it is so important for plant growth in small quantities (but so toxic at slightly higher levels), we are including it at no additional charge.

Region 3:	Water analysis (with GeoTraker electronic data transmission):	$120.00
	Well sampling, analysis, + GeoTraker input:	$155.00

For more information or to discuss your specific needs, please call Dellavalle Lab at **800-228-9896**

For Salinas, Pajaro Valleys and surrounding areas, call Danyal Kasapligil 831-750-4509

Other services available include:

- Well sampling & handling
- Sampling & protocol training
- Well depth sounding
- Soil and plant tissue analysis
- Complete nutrient management for your farming needs
- Irrigation management
- And more . . .

Established in 1978 Dellavalle Laboratory personnel have more than 150 years combined experience providing technical assistance with irrigation and fertility management to California agriculture. Our 10 Certified Crop Advisors all have experience with Nutrient Management.

The laboratory facility is designed specifically to meet agricultural needs and match the stringent environmental standards for this project (ELAP Certification #1595). We excel at rapid turnaround and have high standards for quality.

Please call Dellavalle Laboratory to discuss your specific needs.

FRUIT GROWERS LABORATORY, INC.

Analytical Chemists

Central Coast Grape Growers

Groundwater testing for compliance with the Central Coast Ag Waiver

Introduction

Central Coast Regional Water Quality Control Board recently adopted an updated Irrigated Lands Order (Ag Waiver) to reduce nitrate contamination in drinking water. This order is effective immediately. In this new order, growers are required to sample the groundwater from the primary irrigation well and any drinking water wells in their vineyards.

Fruit Growers Laboratory, Inc. dba FGL Environmental (FGL), is a state certified laboratory providing services to drinking water purveyors and wastewater generators throughout the State of California. FGL is also the largest provider of leaf/ petiole, soils and irrigation water analyses to the grape growing industry throughout California.

For the Central Coast Ag Waiver, ***as it relates to groundwater sampling and analysis only***, FGL provides a turnkey operation to growers (Tiers 1, 2 & 3) to comply with the Water Board's requirements.

Pricing

The following outlines pricing for groundwater sampling and analyses for the current Ag Waiver:

Sampling	$35.00 per well
Depth to water*	$15.00 per well
Field pH	$15.00 per sample
General Chemical analyses	$95.00 per sample

Sampling and analysis cost per well: $160.00

GeoTracker reporting to the State -- $45.00 per chain of custody. (If there are multiple samples on the same chain of custody, only one GeoTracker fee will apply).

Pricing contd......

* For deeper wells, the charge for depth to water will be $40.00 per well. Depth to water will be conducted only on those wells where construction (of the well) provides for this measurement to be taken.

The above charges include substantial discounts from regular pricing.

Chains of Custody

FGL will upload all well details (irrigation and drinking water wells) into our computer system. This enables us to generate the required documentation to comply with the Waiver. This includes preprinted chains of custody, bottle labels, bottle orders and sampling supplies. Bottles and sampling supplies will be provided by FGL, if the grower decides to collect his/her own samples.

Monitoring schedules

- After the first two rounds of monitoring (Fall 2012 and Spring 2013), Tier 1 & 2 growers will repeat this testing (two rounds) every 5 years.
- After the first two rounds of monitoring (Fall 2012 and Spring 2013), Tier 3 growers will conduct testing annually.

Sampling scheduling

Sampling will be scheduled in advance by FGL. Timing of the sampling will coincide with the general timetables outlined in the Waiver. When FGL is required to conduct depth to water measurements, the grower or his agent will shut down the pump and remove the well cap or other access terminals to the well. Once the well depth is recorded, the well will be run for an appropriate period to allow for a representative sample to be collected.

Laboratory Analyses

General chemical analyses, required for each ground water well, will be conducted in our laboratory:

> ***EC, TDS, Alkalinity, Calcium, Magnesium, Sodium, Potassium, Sulfate, Chloride and Nitrate as NO3.***

These do not include the field tests (pH and depth to water) outlined above.

Denis Barry
April 19, 2012

Linda - 831-238-6876

MONTEREY BAY ANALYTICAL SERVICES

PRECISION ACCURACY DEPENDABILITY

4 Justin Court Suite D Monterey, CA 93940
831-375-6227
www.mbasinc.com
montereybayanalytical@usa.net

Central Coast Ag Waiver
Groundwater Monitoring and Reporting Program

The California Regional Water Quality Contol Board, Central Coast Region recently adopted an updated Irrigated Lands Order (Ag Waiver) that requires groundwater monitoring and reporting.

Monterey Bay Analytical Services (MBAS) can provide sampling and laboratory analyses to help growers comply with the Ag Waiver requirements. MBAS is a State Certified Environmental Laboratory (ELAP # 2385) providing laboratory testing since 1999. The staff of MBAS takes pride in producing data that is scientifically sound and legally defensible, as well as offering support and technical advice to our clients. MBAS is located in the Ryan Ranch Business Park in Monterey just off Hwy 68. Clients are encouraged to visit our facility and meet our staff.

MBAS is pleased to offer the following services:

Individual Groundwater Monitoring

Sampling	$35.00 per sample
Groundwater analyses (Table 3 requirements) *	$90 per well
Depth to water (as needed)	$15.00 per well
Total Sampling and analyses cost per well	$140.00

*Panel includes: pH, Conductivity, TDS, Alkalinity. Calcium, Magnesium, Sodium,Potassium, Sulfate, Chloride, Nitrate+Nitrite as N, Nitrates as NO3

Additional services include electronic reporting to GeoTracker database $40.00

Our staff is available to assist with preparation of the monitoring results and well information report as described in part 2B of the monitoring order (Request Quote)

David Holland
Laboratory Director
Monterey Bay Analytical Services

MBAS

MONTEREY BAY ANALYTICAL SERVICES

PRECISION · ACCURACY · DEPENDABILITY

4 Justin Court Ste D, Monterey, CA 93940
831.375.MBAS (6227), 831.641.0734 (Fax)
MontereyBayAnalytical@usa.net
http://www.MBASinc.com

Samples with analysis needing to be completed after normal working hours (M-F, 830-530) may be charged double

2012 Fee Schedule

Chemistry Panels	Analysis	Fee	Containers
Title 22 Primary & Secondary	*Color, odor, turbidity, carbonate, bicarbonate, alkalinity, calcium, chloride, copper, foaming agents, iron, magnesium, manganese, pH, sodium, sulfates, conductivity, TDS, hardness, zinc, corrositivity, silver). Aluminum, arsenic, barium, cadmium, chromium, fluoride, lead, mercury, nitrate, nitrite, selenium, silver, antimony, beryllium, nickel, thallium, cyanide.*	289.00	*250mL glass* *1 liter plastic* *250ml plastic w/ NaOH* *125ml plastic w/ HNO_3* ***(24-hr Hold Time)***
Trihalomethanes (EPA 524)	*Chloroform, bromodichloromethane, dibromochloromethane, bromoform*	95 .00	*3 ea. 40 mL VOH s w/Thio*
HAA-5**	*Haloacetic Acids*	170.00	*250 ml Amber Glass w/ NH_4Cl*
CCR Title 22 Synthetic Organic Compounds**	*Ethylenedibromide & dibromochloropropane (EPA 504.1), Pesticides & PCBs (EPA 505), Herbicides (EPA 515.1, Regulated Organics by GC/MS (EPA 525.2), Carbamates (EPA 531.1), Glyphosate (EPA 547), Endothall (EPA 548.1), Diquat (EPA 549.1), & Diuron (EPA632).* ***Dioxin must be ordered separately if needed.***	1270.00	*EPA 504 3 x 40 mL VOHs Thio* *EPA 505 3 x 40 mL VOHs Thio* *EPA 515 250-ml Glass Thio* *EPA 525 2 x 1-L Glass NaSO3* *EPA 531 250-mL Glass Thio+MCAA* *EPA 547 250-ml Glass Thio* *EPA 548 1-L Glass Thio* *EPA 549 1-L Plastic H2SO4+Thio* *EPA 632 1-L Glass*
VOC's	*Volatile Organic Compounds; EPA 524, EPA 8260*	125.00	*3 ea. 40 ml VOHs w/ HCl*
SOCs for Monterey County**	*Alachlor, Atrazine & Simazine (EPA525), Bentazon & 2,4-D (EPA 515.3), Carbofuran (EPA 531.1), Diquat (EPA 549)*	735.00	*EPA 525 2 x 1-L Glass Thio* *EPA 515.3 250-ml Glass* *EPA 531.1 125-ml Glass MCAA* *EPA 549 1-L Plastic H2so4 + Thio*
Title 22 Radiological**	*Gross Alpha* *Gross Beta* *Radium 226* *Radium 228* *Uranium by ICPMS* *Uranium EPA 908.0*	70.00 70.00 160.00 265.00 100.00 120.00	*1 liter plastic* *1 liter plastic* *1 liter plastic w/ HNO3* *2 liter plastic w/HNO3* *125 ml plastic* *1 liter plastic*
CRC Title 22 Asbestos**		210.00	*1 liter plastic **(Short Hold Time)***
General Water Quality Panel	*pH, alkalinity, conductivity, TDS, calcium, magnesium, sodium, potassium, chloride, fluoride, nitrate, sulfate, corrositivity, hardness, iron & manganese*	125.00	*1 liter plastic* *125ml plastic w/ HNO3*
Irrigation Suitability	*pH, alkalinity, bicarbonate, carbonate, conductivity, total dissolved solids, calcium, magnesium, sodium, potassium, boron, chloride, sulfate, nitrate, SAR and adjusted SAR.*	90.00	*1 liter plastic*
Storm Drain Analysis	*Total suspended solids, pH, Oil and Grease, conductivity.*	90.00	*1 L plastic* *1 L glass*
Coliforms	***Drinking Water**; Total & E. coli; present/absent.*	26.00	*120 ml sterile*
Enterococcus	*Enterococcus by Quantitray*	30.00	*120 ml sterile*
Coliforms	***Source Water**, Total & E. Coli by Quantitray*	30.00	*120 ml sterile*
Coliforms	*Waste water and source water; total ; 15 tube MTF* *Fecal Coliform added to above analysis*	35.00 15.00	*120 ml sterile*

MBAS

MONTEREY BAY ANALYTICAL SERVICES
PRECISION ◉ ACCURACY ◉ DEPENDABILITY
4 Justin Court Ste D, Monterey, CA 93940
831.375.MBAS (6227), 831.641.0734 (Fax)
MontereyBayAnalytical@usa.net
http://www.MBASinc.com

Samples with analysis needing to be completed after normal working hours (M-F, 830-530) may be charged double

2012 Fee Schedule for Individual Parameters

Alkalinity	25.00	500 ml plastic
Aluminum	25.00	125 ml plastic
Ammonia	27.00	500 ml plastic
Anions (Chloride, Fluoride, Nitrate, Nitrite, Sulfate, o-Phosphate)	55.00	250 ml plastic
Arsenic	25.00	125 ml plastic
Barium	25.00	125 ml plastic
Biological Oxygen Demand (BOD)	42.00	1 L plastic
Boron	25.00	125 ml plastic
Bromide	25.00	250 ml plastic
Cadmium	25.00	125 ml plastic
Calcium	25.00	125 ml plastic
Carbonaceous Biological Oxygen Demand	44.00	1 L plastic
Corrositivity (Langelier Index)	55.00	1 L plastic
Chemical Oxygen Demand (COD)	35.00	500 ml plastic
Chloride	25.00	125 ml plastic
Chlorine Residual	20.00	250 ml plastic
Chromium (total)	25.00	125 ml plastic
*Chromium VI**	90.00	250 ml plastic w/$(NH_4)_2SO_4$
Color	15.00	250ml glass
Conductivity	20.00	250 ml plastic
Copper	25.00	125 ml plastic
Cyanide	45.00	250 ml plastic w/ NaOH
Fluoride	25.00	250 ml plastic
General Physical (Color, Odor, Turbidity, pH)	40.00	250 ml glass
Hardness	40.00	250 ml plastic
Hydrogen Sulfide	40.00	250 ml plastic w/ preserve.
Iron	25.00	125 ml plastic
Lead	25.00	125 ml plastic
Lead & Copper Rule (Lead, Copper, Turbidity)	40.00	1 L plastic
Manganese	25.00	125 ml plastic
Magnesium	25.00	125 ml plastic
MBAS (Detergents)	45.00	500 ml plastic
Mercury	35.00	125 ml plastic
Nickel	25.00	125 ml plastic
Nitrate	25.00	250 ml plastic
Nitrite	25.00	250 ml plastic
Odor	18.00	250 ml plastic
Oil & Grease	50.00	1 L glass
Oxygen, Dissolved	15.00	500 ml plastic
*Perchlorate***	85.00	250 ml plastic
PH	15.00	250 ml plastic
Phosphate (ortho)	25.00	250 ml plastic
Phosphorus, Total	35.00	250 ml plastic
Potassium	25.00	250 ml plastic
Selenium	25.00	250 ml plastic
Silica	25.00	250 ml plastic
Silver	25.00	125 ml plastic
Sodium	25.00	250 ml plastic
Sodium Absorption Ratio (SAR & adj SAR)	60.00	250 ml plastic
Sulfate	25.00	250 ml plastic
Settleable Solids	17.00	1 L plastic
Suspended Solids	22.00	1 L plastic

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http://www.MBASinc.com

Samples with analysis needing to be completed after normal working hours (M-F, 830-530) may be charged double

Total Dissolved Solids	22.00	500 ml plastic
Total Kjeldahl Nitrogen	36.00	500 ml plastic
Total Nitrogen (Includes NO3, NO2 & TKN)	70.00	500 ml plastic
*Total Organic Carbon***	65.00	3 x VOA w/ H3PO4
Total Plate Count	32.00	120 ml sterile
Turbidity	20.00	250 ml plastic
Urea	35.00	50 ml plastic (freeze)
Volatile Solids	32.00	500 ml plastic
Zinc	25.00	125 ml plastic

** Samples are subcontracted to another certified laboratory for analysis.

Volume Discounts and Pricing - *Discounts are available based on a specific project or total volume over time.*

Sample Pickup - *Courier Service may be available– call for quotation*

Archived Report - *A $25 fee will be charged for retrieval of archived reports*

QA data package – *Call for quotation*

Sample Containers - *Sample containers are available at no charge*

Payment Terms

Our standard credit terms are Net 30 Days, *and are independent of when clients are reimbursed. Monterey Bay Analytical reserves the right to require payment in advance until a credit application has been approved. A client's initial credit limit may later be increased or decreased, based upon payment history. Accounts over 30 days are subject to 1.5% per month interest. Delinquent accounts are liable for legal costs and collection agency fees incurred by Monterey Bay Analytical Services in its efforts to eliminate the overdue balance. Prices are subject to change without notice.*

Limits of Liability

Monterey Bay Analytical Services performs all of its services in a professional manner using generally accepted analytical methods. These methods are published by recognized sources such as the U.S. Environmental Protection Agency, the American Water Works Association, and the Water Environment Federation. In selecting Monterey Bay Analytical Services to perform analysis, our clients recognize that all samples and sampling events are unique, and that not all samples can be successfully analyzed by generally accepted methods. If analysis proves unsuccessful, the total liability of Monterey Bay Analytical Services shall not exceed the invoiced amount for the services provided. This Limit of Liability shall supersede all clauses to the contrary, implied or otherwise, in any client purchase order or contract, unless different terms are authorized in advance in writing by the director of the Laboratory.

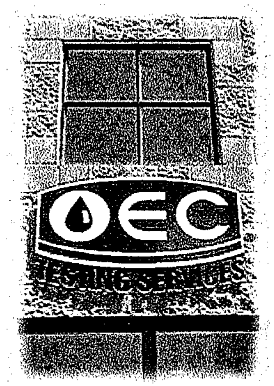
OILFIELD ENVIRONMENTAL AND COMPLIANCE, INC.

Complete Field, Laboratory and Regulatory Compliance

<u>Irrigated Lands Order (Ag Waiver) Ground Water Sampling, Analysis, and Reporting Services</u>

OEC will offers all Tier 1, 2, and 3 agriculture operations a complete turnkey program to comply with Water Boards requirements for ground water sampling, analysis, and reporting.

All services offered by OEC are structured to provide each client with specific, legally defensible solutions to their individual requirements and objectives, utilizing methods and procedures adopted by the Water Board.



- ***Oilfield Environmental & Compliance (OEC) is the <u>ONLY</u> full-service environmental laboratory located on the Central Coast of California***
- ***CALDHS ELAP Certification #2438***
- ***10,000+ sq ft facility in Santa Maria, CA***
- ***Over 40 full-time staff***
- ***Senior Management averages 15+ years of experience***
- ***Trained and OSHA Certified Field Service Technicians***

Pricing of Services:

- ***Sampling $ 35.00 per well***
- ***Depth to water $ 15.00 per well (construction of well permitting)***
- ***Field pH $ 10.00 per well***
- ***Analysis of well water $ 85.00 per well (EC, TDS, Alkalinity, Ca, Mg, K, Na, Sodium, Chloride, and Nitrate as NO3)***
- ***GeoTracker reporting $ 25.00 per well***
- ***Preparation of Report $ 180.00/max per well (As described in part 2 of the monitoring order)***

See back of handout for information included in Discharger Report

Please feel free to contact OEC with and questions regarding our program or to schedule sampling.

307 Roemer Way, Suite 300 Santa Maria, CA 93454
(805) 922-4772 Phone (805) 925-3376 Fax
WWW.oecusa.com

individual groundwater monitoring provisions shall apply and the Discharger shall have one (1) year to comply with the provisions identified in Part 2.

B. Individual Groundwater Reporting

1. **By October 1, 2013**, Dischargers must submit groundwater monitoring results and information, electronically, in a format specified by the Executive Officer. Dischargers must include the following information:
   a. Signed transmittal letter;
   b. Number of groundwater wells present at each farm/ranch;
   c. Identification of any groundwater wells abandoned or destroyed (including method destroyed) in compliance with the Order;
   d. Owner-assigned well identification;
   e. State identification number, if available;
   f. Well location (latitude and longitude);
   g. Water-use category (e.g., domestic drinking water, agricultural);
   h. Identification of primary irrigation well;
   i. Well construction information (e.g., total depth, screened intervals, depth to water), as available;
   j. Use for fertigation or chemigation;
   k. Presence and type of back flow prevention devices;
   l. Photo-documentation of well condition and back flow prevention device;
   m. Identification of wells sampled to comply with the Order and MRP;
   n. Laboratory data must be compatible with the Water Board's Groundwater Ambient Monitoring and Assessment (GAMA) Program, and GeoTracker electronic deliverable format (EDF).

Exhibit 22

J) Farm Water Quality Management Practices Form

Farm Operation/Business Name________________________ AW #:________________

Pesticide Use Permit #:________________________

Key
3 – YES
2 – NO, but planned within 3 years
1 – NO and not planned
N/A – Not applicable

- *Use the Key to determine your level of implementation and planning for the individual management practices.*
- *Circle the corresponding number next to the management practice.*

PESTICIDE MANAGEMENT

3 2 1 N/A P.1) Is an Integrated Pest Management program established?

3 2 1 N/A P.2) Are pest populations assessed and pesticides applied based on scouting data, thresholds and/or risk assessment models?

3 2 1 N/A P.3) Are introduced or managed biological control agents utilized?

3 2 1 N/A P.4) Does pesticide selection consider runoff or leaching potential?

3 2 1 N/A P.5) Does pesticide selection consider toxicity to non-target organisms?

3 2 1 N/A P.6) Is pesticide application equipment regularly inspected, maintained and calibrated to ensure appropriate application rates and distribution?

3 2 1 N/A P.7) Is yearly pesticide training provided for all pesticide handlers who apply, load, mix, transport, clean and repair pesticide application equipment?

3 2 1 N/A P.8) Do pesticide storage facilities have concrete pads and curbs for containment of spills?

3 2 1 N/A P.9) Are pesticide mixing and loading areas located in such a manner to reduce the likelihood of a spill or overflow contaminating a water source?

3 2 1 N/A P.10) Are production wells on elevated concrete bases upslope of pesticide storage and handling facilities?

3 2 1 N/A P.11) Does wellhead protection consist of an elevated concrete seal, sump, or buffer area of 100' around the wellhead and a backflow prevention device?

IRRIGATION WATER MANAGEMENT

3 2 1 N/A I.1) Is drip irrigation distribution uniformity maximized and maintained through regular system equipment and system pressure maintenance?

3 2 1 N/A I.2) Is sprinkler and micro-sprinkler irrigation distribution uniformity maximized and maintained through regular system pressure maintenance and water application during low wind conditions?

3 2 1 N/A I.3) Is furrow and flood irrigation distribution uniformity maximized and maintained by either managing furrow lengths, installing surge irrigation valves, installing irrigation field ditches, or using alternate row irrigation?

3 2 1 N/A I.4) Is your irrigation system design optimized by matching sprinkler nozzle/drip applicator flow rates to the infiltration rate of the soil?

3 2 1 N/A I.5) Are measured or published evapo-transpiration data (CIMIS) used to determine crop water use?

3 2 1 N/A I.6) Is the soil water-holding capacity known?

3 2 1 N/A I.7) Are records kept for each crop irrigated? (Records include the date, amount of each irrigation water applied and the source of water used).

3 2 1 N/A I.8) Have all irrigators who apply irrigation water and maintain irrigation systems received training?

3 2 1 N/A I.9) Has an irrigation mobile lab system evaluation been completed and the system been adjusted accordingly?

Key
3 – YES
2 - NO, but planned within 3 years
1 – NO and not planned
N/A – Not applicable

- *Use the Key to determine your level of implementation and planning for the individual management practices.*
- *Circle the corresponding number next to the management practice.*

EROSION AND SEDIMENT CONTROL MANAGEMENT

3 2 1 N/A E.1) Are cover crops used to protect bare soil from erosion during fallow cycles and to build up soil organic matter as a crop rotation?

3 2 1 N/A E.2) Are hedgerows, trees, and shrubs established along field margins or between field blocks to reduce wind effects and protect slopes from erosion?

3 2 1 N/A E.3) Are farm access roads located and graded to minimize erosion potential?

3 2 1 N/A E.4) Are farm access roads protected from concentrated runoff through the use of vegetative material, gravel, and/or mulch?

3 2 1 N/A E.5) Are ditches and channel banks protected from concentrated flow through the use of grassed waterways, lined channels, and/or diversions?

3 2 1 N/A E.6) Are field layout and row length designed to minimize erosion potential?

3 2 1 N/A E.7) Are sediment basins constructed to intercept sediment-laden runoff in locations where erosion is expected and sediment is known to leave the farm?

3 2 1 N/A E.8) Are water and sediment control basins used in locations where sediment and excess runoff may cause gullies or flooding problems downstream?

3 2 1 N/A E.9) Are vegetative buffers implemented between cropped areas, along the lower edge of the farm, and along roadways? *(This practice is also effective in removing nutrients and pesticides from runoff)*

3 2 1 N/A E.10) Where streams cross or border property are riparian buffers established and maintained?

3 2 1 N/A E.11) Are culverts properly sized and maintained?

3 2 1 N/A E.12) Are implemented management practices evaluated for effectiveness (i.e photo-point monitoring, water quality testing)?

NUTRIENT MANAGEMENT

3 2 1 N/A N.1) Are the crop's nutrient requirements known and are nutrient budgets established and recorded?

3 2 1 N/A N.2) Do you test irrigation water for nitrogen content and incorporate that information into your fertilization program?

3 2 1 N/A N.3) Is plant tissue analysis used to aid in fertilizer decisions?

3 2 1 N/A N.4) Do you test your soil for residual nitrogen and incorporate that information into your fertilization program?

3 2 1 N/A N.5) If fertigation is used are measures in place to ensure that there is no backflow into wells or other water sources?

3 2 1 N/A N.6) Do you regularly maintain and calibrate your fertilizer equipment?

3 2 1 N/A N.7) Do field personnel receive nutrient management training?

3 2 1 N/A N.8) Do fertilizer storage facilities include concrete pads and curbs for containment of spills and are they protected from weather?

3 2 1 N/A N.9) Is mixing and loading performed on sites with low runoff hazard, over 100' downslope of wells?

ADDITIONAL MANAGEMENT PRACTICES

Are any management practices implemented and/or planned for this farm operation that are not listed above? YES NO

If YES, please list below.

____

____

____

Exhibit 23

GROWER REQUIREMENTS | HELP / INSTRUCTIONS

AGRICULTURAL REGULATORY PROGRAM - ANNUAL COMPLIANCE INFO

Name of Operation: **Test Operation (AW9999) -** VIEW OPERATION FORM

Ranch / Farm Name: **Test Farm 3 (Global ID: AGL020013962)**

Section A: General Requirements

Is the information reported in the electronic Notice of Intent (eNOI) accurate and up to date for this ranch/farm? ○ YES ○ NO

Section B: Irrigation Water

What are the primary source(s) of irrigation water on this ranch/farm?:
(check all that apply)

- ☐ Groundwater (Well on Farm)
- ☐ Groundwater (Well off Site)
- ☐ Surface water (Creek or Pond)
- ☐ Recycled water (From On-site or from Purple Pipe)
- ☐ Imported Water (Agency Delivered Water)
- ☐ City Water
- ☐ Spring

What is the maximum Nitrate Concentration (Nitrate as NO3 in mg/L) of the primary irrigation water source on this ranch/farm?

What method was used to determine the maximum Nitrate Concentration (Nitrate as NO3 in mg/L)?

Section C: Groundwater Nitrate Loading Risk Determination

State if the the nitrate loading risk was determined for the ranch/farm or individual units? * For Individual Risk Units, you must upload a spreadsheet to report results

Which method was used to determine the nitrate loading risk for this ranch/farm? (see instructions for Individual Risk Unit reporting)

For BOTH Method 1 and Method 2, identify the crop type used for the determination

For Method 2 ONLY, identify the soil series used for the determination

Report Results of the Nitrate Loading Risk Determination for this ranch/farm:

Method 1 Results

Method 2 Results

Section D: Stormwater Discharge Characteristics

Does stormwater leave this ranch / farm? ○ YES ○ NO

If YES, under what conditions does stormwater leave this ranch/farm during storm events?

Section E: Irrigation Discharge Characteristics

Does irrigation runoff leave this ranch / farm? ○ YES ○ NO

If YES provide the following information:

Where is the closest drainage point from this ranch/farm to any surface water body (e.g., Stream, Lake, Bay, and/or Ocean)?

State the estimated total number of days/year when irrigation runs off/leaves this ranch / farm at any location(s).

State the primary season when irrigation runoff leaves this ranch / farm.

State the estimated maximum total volume of irrigation runoff leaving from your ranch / farm on the highest flow day of the year. Report in gallons per day.

Section F: Tile Drain Discharge Characteristics

Does tile drain water leave this ranch / farm? ○ YES ○ NO

If YES provide the following information:

Where is the closest drainage point from this ranch/farm to any surface water body (e.g., Stream, Lake, Bay, and/or Ocean)?

State the estimated total number of days/year when tile drain water leaves this ranch / farm at any location(s).

State the primary season when tile drain water leaves this ranch / farm.

State the total estimated maximum volume of tile drain water leaving from your ranch / farm on the highest flow day of the year. Report in gallons per day.

DRAFT

Section G: Water Containment Characteristics

Are there water containment structure(s) (i.e., ponds, reservoirs) on this ranch/farm? ○ YES ○ NO

If YES, state the type of treatment or control that is used to minimize and/or prevent the percolation of waste to groundwater.

Section H: Water Quality Management Practices (select all that apply)

Nutrient Management - Practice Implementation

Identify nutrient management measure(s)/practice(s) implemented on this ranch / farm to protect water quality in the last 12 months.

- ☐ None
- ☐ Evaluated how much fertilizer crop needs and timing of application.
- ☐ Scheduled fertilizer applications to match crop requirements.
- ☐ Measured nitrogen concentration in irrigation water and adjusted fertilizer nitrogen applications accordingly.
- ☐ Measured soil nitrate or soil solution nitrate and adjusted fertilizer nitrogen applications accordingly.
- ☐ Measured nitrogen in plant tissue and adjusted fertilizer phosphorus applications.
- ☐ Measured phosphorus in soil and adjusted fertilizer phosphorus applications.
- ☐ Measured nitrogen and phosphorous content of applied manures and other organic amendments.
- ☐ Used urease inhibitors and/or nitrification inhibitors.
- ☐ Modified crop rotation to use cover crops, deep rooted species, or perennials to utilize nitrogen.
- ☐ Used treatment systems to remove nitrogen from irrigation runoff or drainage water (e.g. wood chip bioreactor).
- ☐ Mixed and loaded fertilizers on low runoff hazard sites (e.g. away from creeks and wells)
- ☐ Other, describe in Farm Plan and submit upon request.

Nutrient Management - Practice Assessment

Identify methods used to assess the effectiveness of the implemented management measure(s) / practice(s), to reduce or eliminate the discharge of pollutants from this ranch / farm in the last 12 months.

- ☐ Not Assessed
- ☐ Compared amount of nitrogen applied in fertilizer and in irrigation water to crop need.
- ☐ Measured nitrate concentration below the root zone.
- ☐ Measured nitrate concentration in irrigation runoff.
- ☐ Estimated/measured nitrate load in irrigation runoff.
- ☐ Measured nitrate concentration in surface receiving water.
- ☐ Estimated/measured nitrate load in surface receiving water.
- ☐ Estimated/measured nitrate loading to groundwater.
- ☐ Measured nitrate concentration in groundwater.
- ☐ Modeled or studied nitrate in surface water or groundwater.
- ☐ Consulted Certified Crop Advisor (CCA), UCCE specialist, agronomist, or other similarly qualified professional.
- ☐ Other, describe in Farm Plan and submit upon request.

Nutrient Management - Practice Outcome(s)

Identify outcomes that demonstrate progress towards reducing or eliminating the discharge of pollutants off this ranch / farm in the last 12 months.

- ☐ None
- ☐ Annual fertilizer nitrogen application reduced.
- ☐ Total nitrogen applied as fertilizer and in irrigation water matches crop need.
- ☐ Reduction in nitrate concentration or load, in irrigation runoff.
- ☐ Reduction in nitrate concentration or load, in surface receiving water.
- ☐ Reduction in nitrate loading to groundwater.
- ☐ Reduction in nitrate concentration in groundwater.
- ☐ Water quality standards achieved.
- ☐ Other, describe in Farm Plan and submit upon request.

Irrigation Management - Practice Implementation

Identify irrigation management measure(s)/practice(s) implemented on this ranch / farm to protect water quality in the last 12 months.

- ☐ None
- ☐ Determined amount of crop water uptake and applied irrigation water accordingly.
- ☐ Installed more efficient irrigation system (e.g. microirrigation).
- ☐ Improved irrigation distribution uniformity (DU) based on results of mobile lab or similar assessment.
- ☐ Scheduled irrigation events using soil moisture measurements.

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- [ ] Scheduled irrigation events using weather information.
- [ ] Maintained irrigation system to maximize efficiency and minimize losses (e.g. system components are replaced and/or flushed/cleaned).
- [ ] Selected sprinkler heads,nozzles, and drip tape/emitter with application rate(s) that match system layout, system pressure, and infiltration rates.
- [ ] Recycled or reused excess irrigation water.
- [ ] Contained and/or treated irrigation water runoff prior to discharge off the farm/ranch.
- [ ] Other, describe in Farm Plan and submit upon request.

Irrigation Management - Practice Assessment
Identify methods used to assess the effectiveness of the implemented management measure(s)/practice(s), to reduce or eliminate the discharge of pollutants from this ranch / farm in the last 12 months.

- [ ] Not Assessed
- [ ] Walked the perimeter of the property and cropped areas to verify irrigation runoff has been reduced or eliminated.
- [ ] Recorded amount of irrigation water applied.
- [ ] Recorded and reduced number of tailwater days/year.
- [ ] Compared amount of irrigation water applied to crop water uptake
- [ ] Estimated/measured volume of irrigation runoff.
- [ ] Conducted field quick tests or used handheld meters to determine pollutant concentrations in irrigation runoff or tile drain water.
- [ ] Conducted laboratory analysis to determine pollutant concentrations in irrigation runoff.
- [ ] Modeled or studied amount of irrigation water losses (runoff or percolation).
- [ ] Conducted photo monitoring before and after practice implementation.
- [ ] Consulted Certified Crop Advisor (CCA), UCCE specialist, agronomist, or other similarly qualified professional.
- [ ] Other, describe in Farm Plan and submit upon request.

Irrigation Management - Practice Outcome(s)
Identify outcomes that demonstrate progress towards reducing or eliminating the discharge of pollutants off this ranch / farm in the last 12 months.

- [ ] None
- [ ] Volume of water applied matches crop needs.
- [ ] Annual volume of irrigation water applied reduced.
- [ ] Number of tailwater days/year reduced.
- [ ] Reduction in volume of irrigation runoff.
- [ ] Elimination of irrigation runoff.
- [ ] Reduction in volume of tile drain discharge.
- [ ] Reduction in water infiltration/percolation losses.
- [ ] Reduction in pollutant concentration in irrigation runoff and/or tile drain discharge.
- [ ] Water quality standards achieved.
- [ ] Other, describe in Farm Plan and submit upon request.

Pesticide Management - Practice Implementation
Identify pesticide management measure(s)/practice(s) implemented on this ranch / farm to protect water quality in the last 12 months.

- [ ] None
- [ ] Utilized Integrated Pest Management practices to reduce pesticide use (e.g., pest scouting, other).
- [ ] Applied only organic pesticides.
- [ ] Selected lower risk pesticides to minimize risk to water quality (e.g. based on toxicity, runoff potential, leaching potential).
- [ ] Followed specific label instructions and any local use restrictions.
- [ ] Avoided pesticide applications prior to rain events to prevent runoff.
- [ ] Avoided pesticide applications during windy conditions to prevent drift.
- [ ] Avoided pesticide application in areas adjacent to streams, creeks, or other surface water bodies.
- [ ] Eliminated or controlled irrigation runoff during and after pesticide applications.
- [ ] Eliminated or controlled sediment erosion and movement to avoid transport of pesticides.
- [ ] Treated irrigation runoff with enzymes or other products to breakdown pesticides.
- [ ] Used filter strips, vegetated treatment or other systems to remove pesticides and pollutants from irrigation runoff or tile drain water.
- [ ] Mixed and loaded pesticides on low runoff hazard sites (e.g. away from creeks and wells)
- [ ] Other, describe in Farm Plan and submit upon request.

Pesticide Management - Practice Assessment
Identify methods used to assess the effectiveness of the implemented management measure(s)/practice(s), to reduce or eliminate the discharge of pollutants from this ranch / farm in the last 12 months.

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- [ ] Not assessed
- [ ] Conducted field quick tests or used handheld meters to determine pesticide concentrations or toxicity in irrigation runoff or tile drain water.
- [ ] Conducted laboratory analysis to determine pesticide concentrations or toxicity in irrigation runoff.
- [ ] Measured pesticide concentrations or toxicity in surface receiving water.
- [ ] Measured pesticide concentrations or toxicity in tile drain water
- [ ] Modeled or studied pesticides or toxicity in surface water or groundwater.
- [ ] Conducted photo monitoring before and after practice implementation.
- [ ] Consulted Pesticide Control Advisor (PCA), Certified Crop Advisor (CCA), UCCE specialist, agronomist, or other similarly qualified professional.
- [ ] Other, describe in farm plan and submit upon request.

<u>Pesticide Management - Practice Outcome(s)</u>
Identify outcomes that demonstrate progress towards reducing or eliminating the discharge of pollutants off this ranch / farm in the last 12 months.

- [ ] None
- [ ] Annual pesticide application reduced.
- [ ] Reduction in pesticide concentration or toxicity in irrigation runoff.
- [ ] Reduction in pesticide concentration or toxicity in surface receiving water.
- [ ] Water quality standards achieved.
- [ ] Other, describe in farm plan and submit upon request.

<u>Sediment Management - Practice Implementation</u>
Identify pesticide management measure(s)/practice(s) implemented on this ranch / farm to protect water quality in the last 12 months.

- [ ] None
- [ ] Avoided disturbance of soils adjacent to streams, creeks, and other surface water bodies.
- [ ] Minimized presence of bare soil in non-cropped areas.
- [ ] Minimized presence of bare soil in cropped areas.
- [ ] Minimized tillage to protect soil structure and cover soil.
- [ ] Used soil amendments to protect soil structure.
- [ ] Planted cover crops.
- [ ] Aligned rows for proper drainage and to reduce erosion.
- [ ] Diverted runoff and concentrated flows to grassed areas.
- [ ] Controlled concentrated drainage on roads by grading to reduce erosion or installing culverts, rolling dips, underground outlet pipe(s).
- [ ] Installed filter strips, vegetated treatment or other systems to remove sediment and other pollutants from runoff.
- [ ] Installed sediment basin(s), pond(s), reservoir(s) or other sediment trapping structures to remove sediments from discharge
- [ ] Applied Polyacrylamide (PAM) in irrigation water
- [ ] Other, describe in farm plan and submit upon request.

<u>Sediment Management - Practice Assessment</u>
Identify methods used to assess the effectiveness of the implemented management measure(s)/practice(s), to reduce or eliminate the discharge of pollutants from this ranch / farm in the last 12 months.

- [ ] Not Assessed
- [ ] Walked the perimeter of the property to verify erosion controls and that sediment doesn't leave the ranch/farm during irrigation events and/or storm events.
- [ ] Conducted laboratory analysis, field quick tests or used handheld meters to measure turbidity in irrigation runoff.
- [ ] Estimated sediment load in irrigation and.or stormwater runoff.
- [ ] Conducted laboratory analysis, field quick tests or used handheld meters to measure turbidity in stormwater runoff.
- [ ] Modeled or studied sediment load in surface water.
- [ ] Conducted photo monitoring before and after practice implementation.
- [ ] Consulted Natural Resource Conservation Service (NRCS), Resource Conservation District (RCD), UCCE specialist, or other similarly qualified professional.
- [ ] Other, describe in farm plan and submit upon request.

<u>Sediment Management - Practice Outcome(s)</u>
Identify outcomes that demonstrate progress towards reducing or eliminating the discharge of pollutants off this ranch / farm in the last 12 months.

- [ ] None
- [ ] Soil coverage increased and amount of bare soil reduced.
- [ ] Reduction in turbidity or sediment load in irrigation runoff.
- [ ] Reduction in turbidity or sediment load in stormwater runoff.

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- [ ] Reduction in turbidity or sediment load in surface receiving water.
- [ ] Reduction in stormwater flow and/or volume.
- [ ] Water quality standards achieved.
- [ ] Other, describe in farm plan and submit upon request.

Section I: Cooperative Projects

Is this ranch/farm participating in a specific cooperative water quality improvement project? ◯ YES ◯ NO

If YES provide the following information:

Identify the type of project.

Describe the scale of the project.

Section J: Related Permits

Has any work activity been completed in or near a river, stream, or lake that flows at least intermittently through a bed or channel, within the last 12 months on this ranch / farm, ? (includes water diversions and routine maintenance of canals, channels, culverts, and ditches) ◯ YES ◯ NO

If YES, was a Lake or Streambed Alteration Agreement obtained from the California Department of Fish and Game? ◯ YES ◯ NO

Section K: Photo Monitoring

Photo monitoring is required for Tier 2 and Tier 3 ranches/farms that contain or are adjacent to a waterbody impaired for temperature, turbidity, or sediment (applies to this ranch/farm if the words Monitoring Required are seen next to the title). Photos must be maintained in the Farm Plan and submitted to the Water Board, upon request. Refer to Photo Monitoring protocols at the following website: http://www.waterboards.ca.gov/centralcoast/water_issues/programs/ag_waivers/index.shtml

If required, has photo monitoring been conducted for this ranch or farm? ◯ YES ◯ NO

Proprietary Information

Information related to trade secrets or secret processes are exempt from public disclosure pursuant to Water Code §13267. If the Discharger asserts that all or a portion of a report submitted is exempt from public disclosure the Discharger must provide an explanation of how those portions of the reports are exempt from public disclosure.

Does this Annual Compliance Form contain information related to trade secrets or secret processes)? ◯ YES ◯ NO

Authorization and Certification

By submitting this Annual Compliance Form, in compliance with Water Code section 13267, I certify under penalty of perjury that this document and all attachments were prepared by me, or under my direction or supervision, following a system designed to ensure that qualified personnel properly gather and evaluate the information submitted. To the best of my knowledge and belief, this document and all attachments are true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

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GROWER REQUIREMENTS | HELP / INSTRUCTIONS

AGRICULTURAL REGULATORY PROGRAM - ANNUAL COMPLIANCE INFO

Name of Operation: **Test Operation (AW9999) -** VIEW OPERATION FORM

Ranch / Farm Name: **Test Farm 1 (Global ID: AGL020006840)**

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Section A: General Requirements

Is the information reported in the electronic Notice of Intent (eNOI) accurate and up to date for this ranch/farm?	(●) YES ( ) NO

Section B: Irrigation Water

What are the primary source(s) of irrigation water on this ranch/farm?:
(check all that apply)

- [x] Groundwater (Well on Farm)
- [ ] Groundwater (Well off Site)
- [ ] Surface water (Creek or Pond)
- [ ] Recycled water (From On-site or from Purple Pipe)
- [ ] Imported Water (Agency Delivered Water)
- [ ] City Water
- [ ] Spring

What is the maximum Nitrate Concentration (Nitrate as NO3 in mg/L) of the primary irrigation water source on this ranch/farm?	0 - 45 mg/L Nitrate NO3
What method was used to determine the maximum Nitrate Concentration (Nitrate as NO3 in mg/L)?	Laboratory Analysis

Section C: Groundwater Nitrate Loading Risk Determination

State if the the nitrate loading risk was determined for the ranch/farm or individual units? * For Individual Risk Units, you must upload a spreadsheet to report results	Ranch / Farm
Which method was used to determine the nitrate loading risk for this ranch/farm? (see instructions for Individual Risk Unit reporting)	2 - Nitrate Groundwater Pollution Hazard Index (HI)
For BOTH Method 1 and Method 2, identify the crop type used for the determination	Alfalfa Hay
For Method 2 ONLY, identify the soil series used for the determination	Abra
Report Results of the Nitrate Loading Risk Determination for this ranch/farm:	
Method 1 Results	
Method 2 Results	Low (<= 20)

Section D: Stormwater Discharge Characteristics

Does stormwater leave this ranch / farm?	(●) YES ( ) NO
If YES, under what conditions does stormwater leave this ranch/farm during storm events?	During most rain events

Section E: Irrigation Discharge Characteristics

Does irrigation runoff leave this ranch / farm?	(●) YES ( ) NO
If YES provide the following information:	
Where is the closest drainage point from this ranch/farm to any surface water body (e.g., Stream, Lake, Bay, and/or Ocean)?	Not applicable
State the estimated total number of days/year when irrigation runs off/leaves this ranch / farm at any location(s).	<30
State the primary season when irrigation runoff leaves this ranch / farm.	Summer (June 21 - September 20)
State the estimated maximum total volume of irrigation runoff leaving from your ranch / farm on the highest flow day of the year. Report in gallons per day.	<500

Section F: Tile Drain Discharge Characteristics

Does tile drain water leave this ranch / farm?	(●) YES ( ) NO
If YES provide the following information:	
Where is the closest drainage point from this ranch/farm to any surface water body (e.g., Stream, Lake, Bay, and/or Ocean)?	Not applicable
State the estimated total number of days/year when tile drain water leaves this ranch / farm at any location(s).	<30
State the primary season when tile drain water leaves this ranch / farm.	Summer (June 21 - September 20)
State the total estimated maximum volume of tile drain water leaving from your ranch / farm on the highest flow day of the year. Report in gallons per day.	<500

Section G: Water Containment Characteristics

Are there water containment structure(s) (i.e., ponds, reservoirs) on this ranch/farm? (●) YES ( ) NO

If YES, state the type of treatment or control that is used to minimize and/or prevent the percolation of waste to groundwater.: Not applicable (water quality data indicates no wastes present)

Section H: Water Quality Management Practices (select all that apply)

Nutrient Management - Practice Implementation
Identify nutrient management measure(s)/practice(s) implemented on this ranch / farm to protect water quality in the last 12 months.

- [ ] None
- [x] Evaluated how much fertilizer crop needs and timing of application.
- [x] Scheduled fertilizer applications to match crop requirements.
- [x] Measured nitrogen concentration in irrigation water and adjusted fertilizer nitrogen applications accordingly.
- [ ] Measured soil nitrate or soil solution nitrate and adjusted fertilizer nitrogen applications accordingly.
- [ ] Measured nitrogen in plant tissue and adjusted fertilizer phosphorus applications.
- [ ] Measured phosphorus in soil and adjusted fertilizer phosphorus applications.
- [ ] Measured nitrogen and phosphorous content of applied manures and other organic amendments.
- [ ] Used urease inhibitors and/or nitrification inhibitors.
- [ ] Modified crop rotation to use cover crops, deep rooted species, or perennials to utilize nitrogen.
- [ ] Used treatment systems to remove nitrogen from irrigation runoff or drainage water (e.g. wood chip bioreactor).
- [ ] Mixed and loaded fertilizers on low runoff hazard sites (e.g. away from creeks and wells)
- [ ] Other, describe in Farm Plan and submit upon request.

Nutrient Management - Practice Assessment
Identify methods used to assess the effectiveness of the implemented management measure(s) / practice(s), to reduce or eliminate the discharge of pollutants from this ranch / farm in the last 12 months.

- [ ] Not Assessed
- [x] Compared amount of nitrogen applied in fertilizer and in irrigation water to crop need.
- [x] Measured nitrate concentration below the root zone.
- [x] Measured nitrate concentration in irrigation runoff.
- [ ] Estimated/measured nitrate load in irrigation runoff.
- [ ] Measured nitrate concentration in surface receiving water.
- [ ] Estimated/measured nitrate load in surface receiving water.
- [ ] Estimated/measured nitrate loading to groundwater.
- [ ] Measured nitrate concentration in groundwater.
- [ ] Modeled or studied nitrate in surface water or groundwater.
- [ ] Consulted Certified Crop Advisor (CCA), UCCE specialist, agronomist, or other similarly qualified professional.
- [ ] Other, describe in Farm Plan and submit upon request.

Nutrient Management - Practice Outcome(s)
Identify outcomes that demonstrate progress towards reducing or eliminating the discharge of pollutants off this ranch / farm in the last 12 months.

- [ ] None
- [x] Annual fertilizer nitrogen application reduced.
- [x] Total nitrogen applied as fertilizer and in irrigation water matches crop need.
- [x] Reduction in nitrate concentration or load, in irrigation runoff.
- [ ] Reduction in nitrate concentration or load, in surface receiving water.
- [ ] Reduction in nitrate loading to groundwater.
- [ ] Reduction in nitrate concentration in groundwater.
- [ ] Water quality standards achieved.
- [ ] Other, describe in Farm Plan and submit upon request.

Irrigation Management - Practice Implementation
Identify irrigation management measure(s)/practice(s) implemented on this ranch / farm to protect water quality in the last 12 months.

- [ ] None
- [x] Determined amount of crop water uptake and applied irrigation water accordingly.
- [x] Installed more efficient irrigation system (e.g. microirrigation).
- [x] Improved irrigation distribution uniformity (DU) based on results of mobile lab or similar assessment.
- [ ] Scheduled irrigation events using soil moisture measurements.

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- [ ] Scheduled irrigation events using weather information.
- [ ] Maintained irrigation system to maximize efficiency and minimize losses (e.g. system components are replaced and/or flushed/cleaned).
- [ ] Selected sprinkler heads,nozzles, and drip tape/emitter with application rate(s) that match system layout, system pressure, and infiltration rates.
- [ ] Recycled or reused excess irrigation water.
- [ ] Contained and/or treated irrigation water runoff prior to discharge off the farm/ranch.
- [ ] Other, describe in Farm Plan and submit upon request.

<u>Irrigation Management - Practice Assessment</u>
Identify methods used to assess the effectiveness of the implemented management measure(s)/practice(s), to reduce or eliminate the discharge of pollutants from this ranch / farm in the last 12 months.

- [ ] Not Assessed
- [x] Walked the perimeter of the property and cropped areas to verify irrigation runoff has been reduced or eliminated.
- [x] Recorded amount of irrigation water applied.
- [x] Recorded and reduced number of tailwater days/year.
- [ ] Compared amount of irrigation water applied to crop water uptake
- [ ] Estimated/measured volume of irrigation runoff.
- [ ] Conducted field quick tests or used handheld meters to determine pollutant concentrations in irrigation runoff or tile drain water.
- [ ] Conducted laboratory analysis to determine pollutant concentrations in irrigation runoff.
- [ ] Modeled or studied amount of irrigation water losses (runoff or percolation).
- [ ] Conducted photo monitoring before and after practice implementation.
- [ ] Consulted Certified Crop Advisor (CCA), UCCE specialist, agronomist, or other similarly qualified professional.
- [ ] Other, describe in Farm Plan and submit upon request.

<u>Irrigation Management - Practice Outcome(s)</u>
Identify outcomes that demonstrate progress towards reducing or eliminating the discharge of pollutants off this ranch / farm in the last 12 months.

- [ ] None
- [x] Volume of water applied matches crop needs.
- [x] Annual volume of irrigation water applied reduced.
- [x] Number of tailwater days/year reduced.
- [ ] Reduction in volume of irrigation runoff.
- [ ] Elimination of irrigation runoff.
- [ ] Reduction in volume of tile drain discharge.
- [ ] Reduction in water infiltration/percolation losses.
- [ ] Reduction in pollutant concentration in irrigation runoff and/or tile drain discharge.
- [ ] Water quality standards achieved.
- [ ] Other, describe in Farm Plan and submit upon request.

<u>Pesticide Management - Practice Implementation</u>
Identify pesticide management measure(s)/practice(s) implemented on this ranch / farm to protect water quality in the last 12 months.

- [ ] None
- [x] Utilized Integrated Pest Management practices to reduce pesticide use (e.g., pest scouting, other).
- [x] Applied only organic pesticides.
- [x] Selected lower risk pesticides to minimize risk to water quality (e.g. based on toxicity, runoff potential, leaching potential).
- [ ] Followed specific label instructions and any local use restrictions.
- [ ] Avoided pesticide applications prior to rain events to prevent runoff.
- [ ] Avoided pesticide applications during windy conditions to prevent drift.
- [ ] Avoided pesticide application in areas adjacent to streams, creeks, or other surface water bodies.
- [ ] Eliminated or controlled irrigation runoff during and after pesticide applications.
- [ ] Eliminated or controlled sediment erosion and movement to avoid transport of pesticides.
- [ ] Treated irrigation runoff with enzymes or other products to breakdown pesticides.
- [ ] Used filter strips, vegetated treatment or other systems to remove pesticides and pollutants from irrigation runoff or tile drain water.
- [ ] Mixed and loaded pesticides on low runoff hazard sites (e.g. away from creeks and wells)
- [ ] Other, describe in Farm Plan and submit upon request.

<u>Pesticide Management - Practice Assessment</u>
Identify methods used to assess the effectiveness of the implemented management measure(s)/practice(s), to reduce or eliminate the discharge of pollutants from this ranch / farm in the last 12 months.

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- [ ] Not assessed
- [x] Conducted field quick tests or used handheld meters to determine pesticide concentrations or toxicity in irrigation runoff or tile drain water.
- [x] Conducted laboratory analysis to determine pesticide concentrations or toxicity in irrigation runoff.
- [x] Measured pesticide concentrations or toxicity in surface receiving water.
- [ ] Measured pesticide concentrations or toxicity in tile drain water
- [ ] Modeled or studied pesticides or toxicity in surface water or groundwater.
- [ ] Conducted photo monitoring before and after practice implementation.
- [ ] Consulted Pesticide Control Advisor (PCA), Certified Crop Advisor (CCA), UCCE specialist, agronomist, or other similarly qualified professional.
- [ ] Other, describe in farm plan and submit upon request.

Pesticide Management - Practice Outcome(s)
Identify outcomes that demonstrate progress towards reducing or eliminating the discharge of pollutants off this ranch / farm in the last 12 months.

- [ ] None
- [x] Annual pesticide application reduced.
- [x] Reduction in pesticide concentration or toxicity in irrigation runoff.
- [x] Reduction in pesticide concentration or toxicity in surface receiving water.
- [ ] Water quality standards achieved.
- [ ] Other, describe in farm plan and submit upon request.

Sediment Management - Practice Implementation
Identify pesticide management measure(s)/practice(s) implemented on this ranch / farm to protect water quality in the last 12 months.

- [ ] None
- [x] Avoided disturbance of soils adjacent to streams, creeks, and other surface water bodies.
- [x] Minimized presence of bare soil in non-cropped areas.
- [x] Minimized presence of bare soil in cropped areas.
- [ ] Minimized tillage to protect soil structure and cover soil.
- [ ] Used soil amendments to protect soil structure.
- [ ] Planted cover crops.
- [ ] Aligned rows for proper drainage and to reduce erosion.
- [ ] Diverted runoff and concentrated flows to grassed areas.
- [ ] Controlled concentrated drainage on roads by grading to reduce erosion or installing culverts, rolling dips, underground outlet pipe(s).
- [ ] Installed filter strips, vegetated treatment or other systems to remove sediment and other pollutants from runoff.
- [ ] Installed sediment basin(s), pond(s), reservoir(s) or other sediment trapping structures to remove sediments from discharge
- [ ] Applied Polyacrylamide (PAM) in irrigation water
- [ ] Other, describe in farm plan and submit upon request.

Sediment Management - Practice Assessment
Identify methods used to assess the effectiveness of the implemented management measure(s)/practice(s), to reduce or eliminate the discharge of pollutants from this ranch / farm in the last 12 months.

- [ ] Not Assessed
- [x] Walked the perimeter of the property to verify erosion controls and that sediment doesn't leave the ranch/farm during irrigation events and/or storm events.
- [x] Conducted laboratory analysis, field quick tests or used handheld meters to measure turbidity in irrigation runoff.
- [x] Estimated sediment load in irrigation and.or stormwater runoff.
- [ ] Conducted laboratory analysis, field quick tests or used handheld meters to measure turbidity in stormwater runoff.
- [ ] Modeled or studied sediment load in surface water.
- [ ] Conducted photo monitoring before and after practice implementation.
- [ ] Consulted Natural Resource Conservation Service (NRCS), Resource Conservation District (RCD), UCCE specialist, or other similarly qualified professional.
- [ ] Other, describe in farm plan and submit upon request.

Sediment Management - Practice Outcome(s)
Identify outcomes that demonstrate progress towards reducing or eliminating the discharge of pollutants off this ranch / farm in the last 12 months.

- [ ] None
- [x] Soil coverage increased and amount of bare soil reduced.
- [x] Reduction in turbidity or sediment load in irrigation runoff.
- [x] Reduction in turbidity or sediment load in stormwater runoff.

DRAFT

- [ ] Reduction in turbidity or sediment load in surface receiving water.
- [ ] Reduction in stormwater flow and/or volume.
- [ ] Water quality standards achieved.
- [ ] Other, describe in farm plan and submit upon request.

Section I: Cooperative Projects

Is this ranch/farm participating in a specific cooperative water quality improvement project? (•) YES ( ) NO

If YES provide the following information:

Identify the type of project. Treatment

Describe the scale of the project. Local area

Section J: Related Permits

Has any work activity been completed in or near a river, stream, or lake that flows at least intermittently through a bed or channel, within the last 12 months on this ranch / farm, ? (includes water diversions and routine maintenance of canals, channels, culverts, and ditches) (•) YES ( ) NO

If YES, was a Lake or Streambed Alteration Agreement obtained from the California Department of Fish and Game? (•) YES ( ) NO

Section K: Photo Monitoring

Photo monitoring is required for Tier 2 and Tier 3 ranches/farms that contain or are adjacent to a waterbody impaired for temperature, turbidity, or sediment (applies to this ranch/farm if the words Monitoring Required are seen next to the title). Photos must be maintained in the Farm Plan and submitted to the Water Board, upon request. Refer to Photo Monitoring protocols at the following website: http://www.waterboards.ca.gov/centralcoast/water_issues/programs/ag_waivers/index.shtml

If required, has photo monitoring been conducted for this ranch or farm? (•) YES ( ) NO

Proprietary Information

Information related to trade secrets or secret processes are exempt from public disclosure pursuant to Water Code §13267. If the Discharger asserts that all or a portion of a report submitted is exempt from public disclosure the Discharger must provide an explanation of how those portions of the reports are exempt from public disclosure.

Does this Annual Compliance Form contain information related to trade secrets or secret processes)? (•) YES ( ) NO

If YES, identify the specific section in this Annual Compliance Form where this exempt information is contained and provide a brief justification:

Section - Brief justification

Authorization and Certification

By submitting this Annual Compliance Form, in compliance with Water Code section 13267, I certify under penalty of perjury that this document and all attachments were prepared by me, or under my direction or supervision, following a system designed to ensure that qualified personnel properly gather and evaluate the information submitted. To the best of my knowledge and belief, this document and all attachments are true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

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Exhibit 24

CALIFORNIA FARM BUREAU FEDERATION
NATURAL RESOURCES AND ENVIRONMENTAL DIVISION
2300 RIVER PLAZA DRIVE, SACRAMENTO, CA 95833-3293 · PHONE (916) 561-5665 · FAX (916) 561-5691

Via US Mail and Email
cjones@waterboards.ca.gov
rbriggs@waterboards.ca.gov
aschroeter@waterboards.ca.gov
hkolb@waterboards.ca.gov
lmccann@waterboards.ca.gov

December 3, 2010

Jeffrey S. Young, Chairman of the Board
Roger Briggs, Executive Officer
California Regional Water Quality Control Board
Central Coast Region
895 Aerovista Place, Suite 101
San Luis Obispo, California 93401

Re: ***Draft Central Coast Agriculture's Alternative Proposal for the Regulation of Discharges from Irrigated Agricultural Lands***

Dear Mr. Young and Mr. Briggs,

Please find the attached Draft Central Coast Agriculture's Alternative Proposal for the Regulation of Discharges from Irrigated Agricultural Lands submitted in response to the Central Coast Regional Water Quality Control Board's "Draft Agricultural Order, Draft Monitoring and Reporting Program, Staff Report, and Subsequent Environmental Impact Report for the Regulation of Waste Discharge from Irrigated Lands" released on November 15, 2010. This Draft Agricultural Proposal is submitted on behalf of 7 County Farm Bureaus, as well as numerous additional entities listed at the conclusion of the proposal. Given the draft nature of this agricultural proposal, the agricultural community respectfully requests future and continuing collaboration with Regional Board staff and Board members as a new discharge program is developed.

Sincerely,

Kari E. Fisher
Associate Counsel

cc w/attachments:
John H. Hayashi, Board Member
David T. Hodgin, Board Member
Dr. Monica S. Hunter, Board Member
Russell M. Jeffries, Vice Chairman of the Board
Gary C. Shallcross, Board Member
Tom P. O'Malley, Board Member
Roger Briggs, Executive Director

Draft Central Coast Agriculture's Alternative Proposal for the Regulation of Discharges from Irrigated Agricultural Lands
December 3, 2010

<u>Purpose of the Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Agriculture Lands</u>:

This Alternative Proposal presents an approach for regulating discharges from irrigated agricultural lands through the adoption of a Conditional Waiver of Waste Discharge Requirements, as authorized by Water Code section 13269, which requires dischargers who obtain coverage under the waiver to, in part,

(1) Participate in a region-wide monitoring program that will conduct monitoring and report annually on monitoring results, including the identification of water quality benchmark exceedances;
(2) Develop a confidential, proprietary farm water quality management plan (Farm Plan), which identifies management practices that will address water quality benchmark exceedances that stays on the farm;
(3) Complete a Farm Water Quality Survey and submit it to the Regional Board;
(4) Verification review of a statistically significant sample of Farm Water Quality Surveys per year by a third-party entity or the Regional Board to determine where educational and management practice implementation efforts should be focused;
(4) Implement the Farm Plan and management practices to improve water quality; and
(5) Assess the effectiveness of implemented agricultural management practices in attaining water quality benchmarks and, when necessary to attain water quality benchmarks, and identify, implement, or upgrade management practices.
(6) Participate in the Ag Water Quality Coalition or conduct individual on-farm monitoring, if applicable.

This Proposal sets forth conditions that apply to discharges of waste from irrigated agricultural lands. This conditional waiver of waste discharge requirements constitutes the Central Coast Region Irrigated Lands Regulatory Program.

<u>Legal and Regulatory Considerations:</u>

Water Code section 13260(a)(1) requires that any person discharging waste or proposing to discharge waste within the Regional Board's jurisdiction that could affect the quality of the waters of the state, shall file a Report of Waste Discharge (ROWD) with the Regional Board. The Regional Board may, in its discretion, issue Waste Discharge Requirements (WDRs) pursuant to Water Code section 13263(a). Water Code section 13269 authorizes the Regional Board to conditionally waive provisions of Water Code sections 13260(a)(1) and 13263(a) as to a specific discharge or type of discharge.

Water Code section 13269 requires that any waiver of ROWDs and/or WDRs (Conditional Waiver) must (i) be consistent with any applicable water quality control plans (basin plans); (ii) be "in the public interest;" (iii) contain conditions; (iv) expire after a five year term, but may be renewed in five-year increments; and (v) include monitoring provisions. In addition, Water Code section 13269(a)(4)(A) authorizes the State Water Resources Control Board (State Water Board) to adopt annual fees for recipients of waivers. Water Code section 13269(e) mandates that the Regional Water Boards shall require compliance with the conditions of a waiver of waste discharge requirements.

All requirements for monitoring and reporting are established pursuant to Water Code sections 13267 and 13269. These monitoring and reporting requirements are necessary to evaluate the following: (1) compliance with the terms and conditions of this Conditional Waiver of waste discharge requirements for discharges from irrigated agriculture lands; (2) the effectiveness of any measures or actions taken pursuant to this Conditional Waiver (including water quality management plans); and (3) whether revisions to this Conditional Waiver and/or additional regulatory programs or enforcement actions are warranted. Pursuant to Water Code section 13267, the Regional Board's request for a monitoring program and reports shall bear a reasonable relationship to the burden and need for the report and the benefits to be obtained from the reports. The burden for providing the reports includes costs. Further, when requiring such reports, the Regional Board is required to provide a written explanation with regard to the need and shall identify the evidence that supports the requirement.

Water Code section 13141 states that prior to the implementation of any agricultural water quality control program, an estimate of the total cost of such a program and potential sources of financing must be indicated in any regional water quality control plan. To assist the Regional Board in considering the economic impacts of this action, the Regional Board will consider the estimated costs to Growers to implement this agricultural water quality control program in order to protect water quality consistent with section 13141 of the California Water Code. The Regional Board will also identify potential sources of funding in the Basin Plan.

Legal and Regulatory Rationale for Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Agriculture Lands:

Agricultural discharges, in conjunction with additional sources, contribute to some impaired water quality water segments, which may impact beneficial uses such as, drinking water supplies, aquatic life, agricultural use, and water resources. If additional steps to protect water quality and beneficial uses are not taken, costs and further impacts associated with these resources are likely to increase. Addressing agricultural water quality issues will likely benefit public health, present and future drinking water supplies, aquatic life, aesthetic, recreational, agricultural, and other beneficial uses. Addressing agricultural water quality issues may require changes in certain farming practices, may impose increased costs to individual farmers and the agricultural industry during a time of competing demands on farm income, regulatory compliance efforts, and food safety challenges, therefore potentially impacting the local economy.

Protecting water quality and the environment while protecting agricultural benefits and interests will require reasoned regulation, and increased farm management to achieve reasonable water quality benefits. These regulatory impacts can be reduced through the use of thorough analysis of relevant data, the establishment of reasonable requirements and time schedules, collective group actions and by providing flexibility with respect to how individual farmers can work towards meeting water quality standards through implementation of their individual Farm Plans. To prevent further water quality impairment and impact to beneficial uses, the Central Coast Water Board adopts this feasible, achievable, and reasonable regulatory waiver, which will result in measurable improvements in agricultural water quality discharges on the Central Coast by directly addressing the major water quality issues of toxicity, nitrates, pesticides, and sediment in irrigation runoff and/or leaching to groundwater. The terms of this conditional waiver are consistent with the Water Quality Control Plan for the Central Coast, and are in the public interest.

Background on Irrigated Agricultural Program Implementation (2004 – 2009):

On July 9, 2004, the Central Coast Regional Water Quality Control Board unanimously adopted the 2004 Conditional Waiver, and the associated Monitoring and Reporting Program, with the support of an Agricultural Advisory Panel (including agricultural and environmental interest group representatives), and overall public support. The goal of the 2004 Conditional Waiver was to improve agricultural water quality through the implementation of appropriate management practices. The requirements of the 2004 Conditional Waiver focused on enrollment, education and outreach, development of Farm Water Quality Management Plans (Farm Plans), and cooperative water quality monitoring.

During the term of the 2004 Conditional Waiver, Regional Board staff worked collaboratively with the agriculture community to develop and implement an Irrigated Agricultural Program which would progress to protect and restore surface water quality and groundwater quality to conditions that meet all designated beneficial uses of water in areas with irrigated agricultural lands. Major programmatic accomplishments of the first five years include the following:

- Enrollment of approximately 93 percent of the Central Coast Region's total irrigated agricultural acreage under the 2004 Conditional Waiver;
- Development, implementation, and funding of a region-wide monitoring program (CMP) to assess water quality conditions at the watershed-scale;
- Tracking program implementation for more than 1,700 farming operations (including inspections at 59 farming operations, and various enforcement actions: more than 200 Notices of Violation, more than 20 water quality enforcement actions, and five Administrative Civil Liability complaints);
- Discharger development of Farm Water Quality Management Plans for more than 1,528 operations;
- Discharger completion of water quality education courses (in total, more than 18,000 hours completed);
- Reduction in the use of organophosphates believed to be a source of impairment in surface waters of the state.

- Statistically significant reduction in surface water flow resulting in a reduction in loading of waste in surface waters within the region; and
- Agricultural applications of chlorpyrifos and diazinon decreased by 23 percent (77,986 pounds of active ingredient) from 2004 – 2008 (DPR Pesticide Use Records for Santa Barbara, San Luis Obispo, Monterey, Santa Cruz, and San Benito Counties).

The initial outreach and educational efforts of the Irrigated Agricultural Program were significant. To further address actual water quality impairments, the renewal of the Conditional Waiver can be improved. Thus, progress towards desired water quality outcomes is in need of enhancement. The Central Coast Regional Board must determine how to improve the current program while encouraging agricultural dischargers on the Central Coast to directly address the major water quality issues of toxicity, nitrates, pesticides, and sediment in agricultural surface runoff, and commence to focus on leaching nitrate to groundwater so as to achieve desired water quality outcomes that support all beneficial uses.

This alternative enhanced waiver proposed herein was developed by considering 1) the February 2010 Staff Draft Waiver, 2) the original 2004 Agricultural Alternative, 3) numerous meetings between agriculture representatives and the Regional Board staff, 4) numerous meetings among the diverse agricultural interests on the Central Coast, and 5) consultations with water quality and legal experts throughout the region.

This alternative waiver proposal calls for individual farms to submit new notices of intent (NOIs) to participate in the agricultural waiver, and to identify which of their lands have the potential of irrigation run off to waters of the state. It advances a representative surface water monitoring program to further characterize the water quality in the region's principal water courses, and enable parties to evaluate improved water quality. The watershed monitoring plan would be conducted by a third party monitoring group in accordance with an agreed monitoring protocol. Over time, monitoring locations may need to be readjusted to respond to problems, identify sources, or to respond to data gaps. Monitoring will focus on water quality constituents that have shown to be most prevalent in the region with particular focus on organophosphate and pyretheroid pesticide classes, and nitrates.

The alternative waiver also calls for each farm to craft and maintain an individualized Farm Plan which would identify their farm lands' associated water courses and outline relevant management practices to reduce irrigation return flows and the runoff of contaminants. It would also contain components on grower training/education. Farm Plans may be required to include as components: pesticide management practices and nutrient management practices, both of which would indicate management considerations to reduce discharges of problematic pesticides, and in addition to balancing the application of fertilizers to crop needs. Farm Plans may also include, but are not required to include, SMART (Simple Methods to Achieve Reasonable Targets) Sampling. SMART Sampling is a management practice that includes on-farm sampling of surface irrigation water that allows individual farmers to establish a baseline of farm practices to determine effectiveness of individual farm measures. SMART Sampling data is confidential to the grower and a grower is not required to share SMART Sampling results to the Regional Board during an on-farm review of a Farm Plan.

In promulgating this conditional waiver, the Regional Board recognizes the importance of agriculture as the dominant and most important economic engine and community support basis throughout the region and that these extensive regulatory efforts to control irrigation and drain water constitutes a major undertaking. The Board further recognizes these stated initiatives that requires reasonable phase-in periods and a high level of coordination and cooperation between the agriculture community and the Regional Board to facilitate effective waiver implementation.

The Regional Board also recognizes that farm operators only have the capacity to deal with their own operational inputs or influences on water. Agriculture receives its irrigation water from different sources, some of which enter farm properties with impairments. It would be inappropriate to require a particular farm operator to clean up water to higher quality than what is received, although that often is the situation. The Regional Board further recognizes the importance of tile drainage, particularly in certain areas of this region with historically high water tables, salt build-up, or salt water intrusion and the landmark efforts which have been employed around the mouth of the Salinas River where agriculture has effectively taken urban reclaimed water and, through irrigation, improves that water quality from the point at which it is received to the point that it is discharged.

The Regional Board recognizes the diversity of agriculture throughout the Central Coast Region. The Regional Board further recognizes that crops, irrigation systems, soil type, pesticide and nutrient uses vary widely over the region, which as a result may or may not affect the waters of the State.

This conditional waiver also calls for the exploration into alternative ways to improve water quality through the use of effective management practices, which need to be implemented to the maximum extent practicable. The Regional Board recognizes that agricultural non-point source discharges are best controlled through the implementation of management practices, which will lead to improvement in water quality and move towards compliance with water quality objectives. Whereas in some cases the most effective management practices for protecting water quality are not yet specifically identified, the waiver encourages agriculture to coordinate with the Regional Board to explore these alternatives which might involve different mechanisms for improving water quality in certain areas of the region, such as collective treatment systems.

By the promulgation of this new enhanced waiver, this region's regulatory effort is far beyond any other program to protect water quality developed anywhere else in this state or country.

Scope and Description of Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Agriculture Lands:

A. Eligibility[1]

1. Existing and future discharges from irrigated agricultural lands to waters of the state are potentially eligible for coverage under this Conditional Waiver.

2. Growers eligible under this Conditional Waiver bear the responsibility of complying with the provisions and conditions contained in this Conditional Waiver and others related thereto.

3. Growers eligible under this Conditional Waiver shall comply with the terms and conditions of the Conditional Waiver and take action to improve and protect waters of the State.

B. Enrollment

1. All growers and landowners with discharges from irrigated agricultural lands must complete the following to obtain coverage under the waiver (unless the individual farm has been specifically exempted by the Regional Board, e.g. WDR):
   a. Complete a Notice of Intent (NOI) to Enroll. All growers who are currently enrolled in the 2004 Conditional Waiver must re-enroll by completing a new NOI;
   b. Update Farm Water Quality Management Plan (Farm Plan) to meet additional requirements of the 2011 Conditional Waiver;
   c. Participate in a region-wide monitoring program that will conduct monitoring and report results annually, or obtain an individual MRP from the Regional Board and conduct individual monitoring;
   d. Complete the Farm Water Quality Survey (FWQS) and submit it to the Regional Board;
   e. Participate in a Farm Water Quality Survey verification program administered by a third-party entity that conducts randomized verifications of Farm Water Quality Surveys or elect to have the Regional Board conduct randomized verifications of Farm Water Quality Surveys. Both the third-party entity and the Regional Board will be responsible for reviewing and verifying FWQSs and reporting annually on aggregated results from the verification reviews.
   f. Continuing Education: Operators need to complete 5 hours of water quality continuing education (which can include, but is not limited to: workshops,

[1] This Conditional Waiver does not waive WDRs for commercial nurseries, nursery stock production, and greenhouse operations that have point-source type discharges, and fully contained greenhouse operations (those with no groundwater discharge due to impervious floors). These operations must eliminate all such discharges of waste or submit an ROWD to apply for individual WDRs as set forth in Water Code section 13260. However, if such operations have no discharge or no potential to discharge, there is no need to apply for either WDRs or a Conditional Waiver.

field days, and technical assistance), as long as resources are available, over the term of the Conditional Waiver. Documentation for completing continuing education should be retained in the Farm Plan.

g. Participate in a Water Quality Coalition for Agriculture or conduct individual on-farm monitoring, if applicable (see Section D, infra).[2]

Notice of Intent

2. Components of the Notice of Intent include:
   a. Completed application form which includes the Assessor's Parcel Number of the enrolled ranch/ranch operation;
   b. Copy of the map of operation;
   c. Statement of commitment to complete a Farm Plan;
   d. Completed Farm Water Quality Survey;
   e. Election of participation in the Cooperative Monitoring Program or an Individual MRP;
   f. Statement of participation in the FWQS verification program administered by a third-party entity or election to have FWQS verifications completed by the Regional Board;
   g. Election of participation in an Water Quality Coalition for Agriculture or election to conduct individual on-farm monitoring, if applicable (see Section D(1) and (2));
   h. Identification of the Landowner; and
   i. Grower identification of the net irrigated acres.

3. The completed NOI must be submitted to the Regional Board within 4 months after adoption of this Conditional Waiver.

4. *Exemptions from Notice of Intent and Other Waiver Requirements:*
   a. A Certificate of Sustainability[3] from a State of California government entity approved program may be submitted in lieu of the NOI as long as the Certificate of Sustainability is submitted by the time when a NOI must be submitted.
   b. A Certificate of Sustainability from a State of California government entity approved program may also be considered to meet all requirements pertaining to Farm Water Quality Management Plans (Section B(5)), Water Quality Assessments (Section B(6)), and Water Quality Coalition for Agriculture requirements or individual on-farm monitoring requirements (Section D) as long as the approved program issuing the Certificate of Sustainability includes evaluation of irrigation efficiency, pesticide management, sediment management, fertilization management, and documents efficiency of

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[2] If a grower is subject to the provisions in Section D below and elects to participate in a Water Quality Coalition for Agriculture, then the grower need not participate in a FWQS verification program as the Water Quality Coalition for Agriculture audit provisions shall substitute for the third-party entity verification provisions identified here

[3] A Certificate of Sustainability includes, but is not limited to, some form of documentation or verification of performance, stewardship index, and/or implementation of state certified good agricultural practices that are protective of water quality.

associated best management practices for the protection of water quality through university research or a representative sample of individual farm verifications once every five years.

c. A Certificate of Sustainability from a State of California government entity does not exempt the individual from participating in a region-wide monitoring program.
d. A Certificate of Sustainability must include the Assessor's Parcel Number of the enrolled ranch/ranch operation, election of participation in the Cooperative Monitoring Program or an Individual MRP, and identification of the Landowner.

Farm Water Quality Management Plan

5. Except as specified in section 4, all Growers must complete a Farm Plan. The various components of the Farm Plan will help identify which water quality improvement actions are to be required in the Conditional Ag Waiver.
   a. The Farm Plan is a flexible detailed plan outlining a grower's management practices as they pertain to water quality.
   b. The Farm Plan contains proprietary information and is not intended to be public information. The original shall remain on the farm and shall be made available to Regional Board staff upon adequate notice of inspection for on site review. Contents of the Farm Plan shall not be made or discussed during any open, public session of the Regional Board even if being reviewed for regulatory and/or enforcement activities. Should it be necessary for the Regional Board to discuss the contents of an individual Farm Plan, all such discussions shall be conducted in closed session and the Regional Board Counsel shall only report publicly a summary of any action taken by the Regional Board in closed session that pertains to the Farm Plan.
   c. This Plan should include, at a minimum, a description and/or discussion of current farm water quality conditions and challenges.
   d. Specific components that address known impairments or identified farm water quality conditions or challenges shall be included in the Farm Plan. Examples of such components shall include the following when applicable to the specific farm:
      i. Irrigation Management Practices
         - A grower will have to plan to address and improve (where appropriate) irrigation efficiency by addressing the irrigation delivery (distribution uniformity) and/or irrigation scheduling (matching irrigation application to crop ET demand using various tools involving soil, plant, and/or weather assessments).
         - Irrigation efficiency of applied irrigation water should be known and a plan for improvement should be included, if applicable.
         - A grower will have to plan to address efficient irrigation practices by addressing the irrigation delivery and/or irrigation scheduling, whichever is appropriate, if applicable.

ii. Pesticide Management Practices
   - Pesticides used by the grower that may contribute to water quality toxicity should be identified, if applicable.
   - Management practices for controlling off-site discharge of irrigation water with pesticides should be identified, if applicable.
   - Demonstration of compliance with Pesticide Surface Water Regulations adopted by the California Department of Pesticide Regulations (DPR) when such regulations become effective and applicable.
   - Demonstration that the grower is implementing pesticide management practices that have become generally accepted standard practices in California (e.g. spray equipment calibration, proper pesticide storage, well-head protection, drift management, pest scouting techniques, and use of treatment thresholds), if applicable.

iii. Sediment Management Practices
   - Address sediment discharges through source controls (e.g. Landguard, PAM, etc.), pollution prevention practices, or technical mitigations that are feasible in a commercial agricultural production system, if applicable.
   - Control of sediment shall be consistent with Food Safety requirements as applicable to individual growers.

iv. Fertilizer Management Practices
   - Growers shall develop a Proprietary Nutrient Management Plan (NMP) that includes soil analysis, well water analysis and/or plant tissue analysis, as applicable. This will allow the grower to account for nutrients that have been "banked" in the soil profile.
   - A grower will efficiently use fertilizer while maintaining an adequate margin of error as necessitated for commercial agricultural production.
   - Growers will prepare a Proprietary Nutrient Management Plan, if applicable, which needs to identify individual-management practices, taking into consideration the level of nitrate in the irrigation source water when calculating the amount of fertilizer needed. This will be the mechanism by which growers implement practices to address both irrigation water runoff and groundwater nitrate impairments.
   - The NMP may not be reported on, referenced or otherwise referred to, in any further manner, than through the proprietary Farm Plan; or, as an aggregated report on a sub-watershed.

e. This Plan may include, but is not required to include, on farm verification sampling of surface irrigation water run-off to assist an individual grower to understand potential contributions to water quality impairments. Individual on-farm sampling (e.g., SMART Sampling to establish a baseline of farm practices, to determine effectiveness of individual farm measures, etc.) is a voluntary management practice. Data collected from SMART Sampling is confidential, part of the management practice itself, and not subject to review and inspection by Regional Board staff upon review of the Farm Plan.

Farm Water Quality Survey

6. Except as specified in section 4, all Growers must complete a Farm Water Quality Survey (FWQS). The FWQS is to be used as an educational tool for the Grower. The FWQS replaces the current management practices checklist and is a self-assessment tool individually completed by each grower. The FWQS is a short questionnaire that identifies and demonstrates farm water quality management practices and aids the grower in determining where educational and management practice implementation efforts should be focused.

7. Upon enrollment, growers are required to submit the FWQS to the Regional Board.

8. Depending on Grower election in the NOI, a third-party entity, such as the entity conducting the Cooperative Monitoring Program, or the Regional Board shall randomly verify FWQSs on an annual basis, beginning in year 2 of the Waiver.[4] For third-party entities conducting the verifications, randomized FWQS verifications shall include twenty percent of the enrollees over the course of the Waiver, which represents a statistically significant sample size, that have elected to participate in the third party entity. Likewise, the Regional Board shall conduct randomized FWQS verifications of twenty percent of the enrollees over the course of the Waiver that have elected to have the Regional Board conduct the verifications. The third-party entity shall submit an annual report that summarizes the results of its review of FWQSs. The annual report shall include the number of enrollee FWQSs evaluated, the percent of FWQSs that properly reflected operations for which the FWQS applied, and identify aggregate areas in which educational and management practice implementation efforts should be focused. The annual report shall not include the names of the enrollees evaluated or proprietary information. The Regional Board shall prepare a similar annual report summarizing its FWQS verifications and make the report available to the public.

C. Monitoring

Surface Water

1. Surface water quality monitoring shall be conducted in receiving waters with sufficient frequency and at a sufficient number of locations to a) characterize water quality conditions and b) understand long-term water quality trends.

[4] For Growers and/or landowners subject to the requirements of Section D of this waiver, if the grower and/or landowner elects to participate in an Water Quality Coalition for Agriculture, the audit provisions in Section D shall substitute for the third-party entity verification provisions required here.

Receiving waters monitored should reflect agricultural inputs, and information from the program should clarify sources of impairment and provide feedback to growers in areas of concern.

2. Growers shall participate in a region-wide Cooperative Monitoring Program (CMP) or obtain an individual Monitoring and Reporting Program.

3. Water quality data shall be collected as per the attached Monitoring and Reporting Program (MRP).
   a. An improved CMP/MRP plan will support stated objectives.
   b. The purpose of the Monitoring and Reporting Program Requirements is to assess the impacts of waste discharges from irrigated lands on waters of the state, and, where necessary, to track progress in reducing the amount of waste discharged that affects the quality of the waters of the state and their beneficial uses.
   c. The entity in charge of the Cooperative Monitoring Program shall submit the results of the water quality monitoring to the Regional Board annually in accordance with the Monitoring and Reporting Program Requirements.

Water Quality Improvement Actions:

4. Based on information obtained from annual monitoring reports, Regional Board reviews of submitted FWQSs, and Regional Board review of Farm Plans, the Regional Board shall work with the local agricultural community to identify further water quality improvement actions for growers in areas where water quality is highly impaired and schedule meetings with groups of growers to discuss management practices that should be implemented to address specific impairments.

5. The Regional Board may conduct follow-up inspections to verify that growers in highly impaired areas are implementing practices discussed during group grower meetings.

Water Quality Implementation Verification:

6. In order to assess implementation of management practices that are designed to protect water quality, seven methods of implementation verification and measurement will occur:
   a. Farm Water Quality Surveys;
   b. Randomized verification of FWQSs throughout the Region;
   c. Reported grower group meetings;
   d. Focused Regional Board inspections on farms most likely to be causing impairments;
   e. CMP receiving water quality monitoring;
   f. CMP Follow Up Monitoring; and
   g. Compliance with Milestones.

7. If the implementation verifications and receiving monitoring results indicate that irrigation return flow discharges from a grower's operation may cause an exceedance of a water quality benchmark in a water of the state, then the Individual Discharger shall, in accordance with an approved Farm Plan, implement additional targeted management practices that are intended to further work toward attaining water quality benchmarks.

Groundwater

8. Groundwater in many areas of the region shows nitrate levels exceeding drinking water standards. Groundwater nitrate problems may have resulted from many sources and over many years. Growers will not be held liable for historical conditions. Since high nitrate groundwater in agricultural areas is often used for irrigation, Farm Plans should include a Proprietary Nutrient Management Plan to ensure that current discharges to groundwater do not further degrade groundwater. Plans also should account for specific nitrate concentrations in irrigation water in determining agronomic nitrogen application rates. (See Section B(5)(iv).)

9. A review of groundwater quality data in the Central Coast Region reveals that groundwater may be contaminated with pollutants, such as nitrate, that can be contained in irrigated agriculture discharges. Such data demonstrates that groundwater basins underlying areas with irrigated agriculture lands may contain levels of nitrate that exceed applicable water quality objectives, which are based on state drinking water standards. It is expected that source control management practices, such as improved irrigation efficiency and fertilizer management, employed by Growers to attain surface water quality benchmarks will reduce loading to groundwater as well. The number of existing groundwater wells in the Central Coast Region is adequate to assess broad changes in groundwater quality as a result of implementation of management practices under the Conditional Waiver.

10. Dischargers must conduct annual groundwater sampling of one primary groundwater well on their operation for nitrates, TDS or EC, and pH. Groundwater sampling must be conducted in the same months each year, as determined by the grower. All results are to be kept in the Farm Plan. Such sampling requirements do not apply to delivered water. If a grower's delivered water sources provide at least annual testing reports for nitrates, TDS, and pH, a grower does not have to conduct individual tests. However, copies of those reports provided by the delivered water sources must be included in the Farm Plan.

11. Agriculture will commit to work with other stakeholder groups on the SWRCB Ground Water Basin Management Planning process (plans are due in 2017).

12. The Regional Board shall use existing historical data collected by other agencies and recent groundwater nitrate projects (e.g., UCD Nitrate Assessment project or the SBS2X 1 project) and current groundwater monitoring data (e.g., Groundwater Ambient Monitoring & Assessment Program, Department of Pesticide Regulation, Department of Public Health, Department of Toxic Substances Control, and data

compiled by local groundwater management agencies and Integrated Regional Water Management Plans) to ground truth and quantify present conclusions regarding groundwater impairment trends.

13. Specifically, the Regional Board shall utilize existing monitoring programs and shall expand on its partnership opportunities to rely on the appropriate local entities and state agencies involved in groundwater monitoring and protection, including but not limited to the Department of Water Resources, Department of Pesticide Regulation, Department of Public Health, etc., to compile, analyze, and utilize existing groundwater data and protection programs, and identify gaps, prior to proceeding with the adoption, regulation, and enforcement upon potential dischargers within the Central Coast. The appropriate local entities will vary throughout the Central Coast and may include local public agencies and integrated regional water management planning agencies.

14. During the term of the Waiver, existing county resource agencies or a third-party may develop groundwater quality management plans (GQMPs) designed to minimize waste discharge to groundwater from irrigated agricultural lands. As part of GQMP development, they may 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. Where local agencies have developed local groundwater management plans (e.g., AB 3030, SB 1938, Integrated Regional Water Management plans), the local groundwater management plan may be an appropriate GQMP. However, the Waiver does not require the development of GQMPs at this time.

D. Region 3 Water Quality Coalition for Agriculture

Enrollment Criteria

1. Unless otherwise exempted pursuant to the provisions in section D(2) below, all growers and landowners with irrigated lands in Region 3 meeting any of the following criteria below must also either join a region-wide Water Quality Coalition for Agriculture, or conduct individual on-farm monitoring of irrigation return flows leaving the property:[5]
    a. Operations with an acre of row crops with high nitrate loading potential; or
        i. Row Crops with High Nitrate Loading Potential include, but are not limited to: Crops in the Brassica family with high nitrate loading potential, Leafy Greens with high nitrate loading potential, Artichokes, Beans, Beets, Corn, Cucumber, Daikon, Leek, Onion,

[5] If a grower/landowner does not meet any of the enrollment criteria in Section D(1), the grower/landowner is not required to join a region-wide Water Quality Coalition for Agriculture, or conduct individual on-farm monitoring of irrigation return flows leaving the property.

Peas, Pepper, Pumpkin, Potato, Radishes, Squash (including Summer), Strawberries, and Tomatoes.[6]

ii. Crop types may be identified using the Code of Federal Regulations, Title 40, Part 180.

iii. Nitrate Loading Risk Factors may be identified by using the UC Riverside Nitrate Hazard Index.

b. Operation has irrigated land that discharges tail-water; or

c. Operation has irrigated land that discharges sediment during irrigation.

2. ***Exemptions from Requirements to Join a Coalition***: Growers and/or landowners meeting the criteria in section D(1) above may further be exempted from Section D under the following circumstances:
   a. The grower or landowner submits a Certificate of Sustainability pursuant to section B(4) above; or
   b. Growers/Landowners who assert that their nitrate loading risk calculation is valued less than 15 points may apply to the Executive Officer or the Coalition for an exemption. (See Table 1 for Nitrate Loading Risk Factor Criteria.) If the grower/landowner can prove an index of less than 15 points and is provided certification of this by the Regional Board or the Coalition, the grower/landowner may be exempted from participation in the Coalition. This certification is valid for the coming two years and will need to be renewed during the life of the waiver.

Additional Requirements for Coalition Members

3. If a grower and/or landowner elects to participate in an Water Quality Coalition for Agriculture in lieu of on-farm monitoring requirements, Coalition participants may be subject to various levels of audits described in section(s) below as conducted by the Water Quality Coalition for Agriculture.
4. Coalition audits may be used to determine, including but not limited to, the following:
   a. Chlorpyrifos – If a grower uses chlorpyrifos and has irrigated water runoff, a Coalition audit would focus on whether they are:
      i. Using BMPs that are focused on the remediation of this material.
      ii. Reducing the use of these products in acreage areas where the grower has irrigation water runoff.
      iii. Operating with authority to use these materials by complying with a special use permit restriction from their County Agricultural Commissioner or the Department of Pesticide Regulations (i.e. pending surface water regulations by DPR).
   b. Diazinon – If a grower uses diazinon and has irrigated water runoff, a Coalition audit would focus on whether they are:
      i. Using BMPs that are focused on the remediation of this material.
      ii. Reducing the use of these products in acreage areas where the grower has irrigation water runoff.

[6] The Coalition may revise and expand this list as appropriate.

iii. Operating with authority to use these materials by complying with a special use permit restriction from their County Agricultural Commissioner or the Department of Pesticide Regulations (e.g., pending surface water regulations by DPR).

Audit Provisions

5. Coalition participants may be subject to the following audit provisions as described below. At a minimum, the Water Quality Coalition for Agriculture must conduct pre-audit evaluations of at least 20% of the Coalition participants during the term of the Waiver. The Water Quality Coalition for Agriculture may choose to conduct additional pre-audit evaluations at its discretion.

6. ***Pre-Audit Evaluation:*** The pre-audit evaluation will include review of the FWQS, sub-watershed monitoring data, and/or conduct field visits to identify priority sub-watersheds. Within identified priority sub-watersheds, the following pre-audit actions will be taken:
   a. If a nearby CMP site shows that OPs and pyrethroids are present, a grower's pesticide management plan as well as the grower's BMPs for pesticide use will be reviewed and recommendations of technical resources and/or services will be made.
   b. The Coalition will verify if there is or is not irrigation water runoff present as reported on the FWQS.
      i. If the FWQS incorrectly reports the presence or non-presence of irrigation water run-off, the Water Quality Coalition for Agriculture will report the discrepancy to the Regional Board within 30 days. The entity responsible for the Cooperative Monitoring Program will also be provided a copy of that list.
      ii. When reporting the presence or non-presence of irrigation water run-off as reported on the FWQS, an auditor will provide a narrative for observed anomalies or exceptions. For example, when documenting irrigated water runoff in cases where the presence of water leaving the field is in dispute, the water runoff is an aberration, or there was general confusion, the auditor will include such explanation in his/her report. This narrative will not define the geographic location at which water was leaving the field or identify the grower any more than they are identified in the NOI. Neither of these will be reported to the Regional Board unless the dispute in question is resolved and it is found that the grower has incorrectly reported the presence of irrigation water runoff on his/her FWQS.

7. ***Primary Audit:*** If a Coalition participant has irrigated water runoff, they may be subject to a primary audit conducted by the Water Quality Coalition for Agriculture. A primary audit may include all of the following:
   a. Be conducted for contiguous parcels of land;

b. Include review of the NOI, Farm Plan, Nutrient Management Plan, and Pesticide Management Plan; Review of the pesticide management plan will consider what a grower will do if they have certain pests, disease and weeds, and will take into account pressures from weather, pest infestation, etc.
c. Verify BMP implementation.
d. Promote the adoption of SMART Sampling.
   i. The goal of SMART Sampling is two-fold:
      - Identify water quality issues in a farm's discharge(s);
      - Assess the impacts/effectiveness of specific practices that the farmer is trying to improve the quality of the discharge(s).
   ii. SMART Sampling is confidential to the grower. A majority of the tests can be performed on the farm, and the data will always be left with the grower. The tests that need to be done by a laboratory (pesticides) are returned to the grower as a hard copy report, and no other report is sent out by the lab.
e. Primary Audit scoring will be a point-value process created by technical service providers and agricultural stakeholders.
f. The Primary Audit score will:
   i. Provide a basis for differentiating proactive growers from those who are less proactive.
   ii. Indicate where BMP efforts are needed.

8. ***Secondary Audit***: Coalition participants that are subject to primary audits may be subject to secondary audits if the primary audit score is considered to warrant the need for further action as identified by technical service provisions and agricultural stakeholders. Secondary audits may consist of, but is not limited to, the following:
   a. Assess effectiveness of BMP Implementation;
   b. Determine trend line by comparing initial audit and second BMP audit; Verify nutrient management program implementation;
   c. Include training regarding use of devices that monitor how water moves through the root zone; and
   d. Include training on nutrient management.

9. ***Audit Reporting***: Audit results, which includes pre-audit evaluations, primary audits and secondary audits, will be reported to the Regional Board in aggregate, based on priority sub-watersheds or priority reaches on a main-stem tributary on an annual basis.

10. Prior to reporting audit results, auditors will review the audit results with growers before a final score is tallied. This will provide growers the opportunity to learn from the audit process, as well as answer any questions posed by the auditor. The auditor will have the final say on the audit report and score. The Water Quality Coalition for Agriculture may establish a grower appeal process within the Coalition structure to address circumstances where there is disagreement between

the auditor and the grower. All appeals must be resolved prior to any aggregated scores being reported to the Regional Board.

Coalition Function and Structure

11. A qualifying Water Quality Coalition for Agriculture must:
    a. Provide a Bridge between growers and technical resources and technical service providers;
    b. Conduct pre-audit evaluations of at least 20% of operations enrolled in the Water Quality Coalition for Agriculture during the term of the waiver, conduct primary audits of farms with irrigation water run-off in priority sub-watersheds of the Coalition, focusing on most impaired sub-watersheds as first priority, and conduct secondary audits of those farms identified as needing additional assistance;
    c. Rank priority watershed areas;
    d. Notify the Regional Board if a Coalition participant fails to participate in good faith (e.g., fails to pay required fees to maintain Coalition operations); and
    e. Identify audit timelines by priority sub-watershed.

12. To be a qualifying Water Quality Coalition for Agriculture, the Coalition must submit a Notice of Intent to the Regional Board within 90 days of adoption of the Waiver. The Notice of Intent shall include the name of the Water Quality Coalition for Agriculture, the geographic area and/or commodity for which the Water Quality Coalition for Agriculture intends to cover, contact information and an explanation as to how the Water Quality Coalition for Agriculture intends to operate and conduct the functions identified above. The Executive Officer of the Regional Board shall approve any Water Quality Coalition for Agriculture that meets the requirements specified here. If a Water Quality Coalition for Agriculture fails to provide the required reports in a timely manner, the Executive Officer may terminate the Water Quality Coalition for Agriculture. If termination of a Water Quality Coalition for Agriculture occurs, the Coalition participants may join another Water Quality Coalition for Agriculture, or form a new Water Quality Coalition for Agriculture within 60 days. If a Coalition participant does not join another existing Water Quality Coalition for Agriculture or participate in a newly formed Water Quality Coalition for Agriculture, then the Coalition Participant may be subject to individual on-farm monitoring requirements for the remainder of the term of the Waiver.

13. To conduct the activities specified in provisions 5 – 12 above, the Regional Board shall provide to qualifying Water Quality Coalitions for Agriculture the NOI and FWQS information for growers and/or landowners that elect participation in a Water Quality Coalition for Agriculture. The information shall be provided to applicable Water Quality Coalitions for Agriculture within 60 days after the deadline for submittal of grower/landowner NOIs has expired.

14. Qualifying Water Quality Coalitions for Agriculture should focus their priorities on irrigation water runoff and nutrient management plans.

15. A qualifying Water Quality Coalition for Agriculture may:
    a. Coordinate receiving water monitoring and data management as required in Section F of this Order;
    b. Provide assistance to growers and landowners in updating Farm Water Quality Plans and assist with preparation of Nutrient Management Plans;
    c. Develop sub-committees to assist in the efficient administration of the Coalition activities; and
    d. Provide assistance for the development of a Collective Treatment Systems where growers have expressed an interest.
        i. Collective Treatment Systems may be used in watersheds and sub-watersheds where appropriate and applicable. These systems will require engineering that is specific, and should include best available research and technical support along with collaboration from public agencies, academic, and the landowners/operators in the watershed. Consideration by grower(s) to participate is that irrigated water runoff can reasonably be expected to contribute to the collective treatment system and that it is practical to expect that the investment would lead to improvement in water quality. Grower(s) participation in such a system will be considered a significant BMP mitigation to improve water quality in Coalition audits. Participating grower(s') fee schedule within the Coalition will be adjusted as appropriate to provide the public/private funding needed.

E. General Timelines for Implementation

- March 2011: New Waiver Adopted.

- April 2011: Outreach to Growing Communities begins to implement new waiver and file paperwork.

- June 2011: CCWQP, Inc. organization is updated to gain capacity to manage updated program including FWQS verifications or, if CCWQP, Inc. is unable, a new organization (or organizations) is established to manage multiple objectives and facilitate monitoring, conduct FWQS verification reviews, and assist in completion of nutrient management programs.

- June 2011: Deadline for Water Quality Coalition for Agriculture to submit NOI

- July 2011: Deadline for growers and/or landowners to submit NOI and completed FWQS to Regional Board.

- October 2011: Deadline to submit Statement of Completion of completed Farm Plan to Regional Board (Farm Plan shall remain on farm).

- October 2011: Deadline for Regional Board to provide qualifying Water Quality Coalitions for Agriculture NOI and FWQS information.

- October 2011 – September 2012: 5% of FWQSs will be verified by a third-party entity or the Regional Board, and annually thereafter.

- July 2012 – July 2013: Nutrient Management Plan outreach conducted.

- October 2013: All growers must update their farm plan to show that they have a nutrient management plan in place, if applicable, along with any other updates.

- November 2014: Growers make any updates to their farm plan.

F. Milestones

Table 1. All Dischargers with discharges from irrigated agricultural lands must comply with the following time schedule.

Task	Compliance Date
Submit completed Notice of Intent and Farm Water Quality Survey	**For existing Dischargers enrolled under the 2004 Conditional Waiver** – Within 4 months after Board adoption of the Order; For any **Discharger** acquiring control or ownership of an existing operation – Within 30 days of acquiring control or ownership of an operation; For any **new proposed Discharger** – Prior to any discharge.
Update and Implement Revised Farm Plan	Within 1 year of adoption of the Order.
Complete 5 hours of Farm Water Quality Education.	Within 2 years of adoption of the Order.
The third-party entity conducting the Cooperative Monitoring Program shall submit an updated Quality Assurance Project Plan (QAPP) and Sampling and Analysis Plan for Coordinated Monitoring Program for Executive Officer approval.	Within 6 months from adoption of this Order.
State Date for Implementing Coordinated Monitoring Program.	Within 3 months of Executive Officer approval of QAPP.
Submit Receiving Water Quality data.	Within 3 months after start of monitoring, and quarterly thereafter.

Submit Receiving Water Quality Annual Monitoring Report.	Within one year, and annually thereafter.

Table 2. Surface waters must meet the following time schedule and milestones.

Milestone	Compliance Date
Using current CMP data, reduce chlorpyrifos and diazinon toxic units at current CMP sites.	Within 4 year of adoption of the Order, reduce chlorpyrifos and diazinon toxic units by 50%. Within 8 years of adoption of the Order, meet water quality objectives for chlorpyrifos and diazinon.
Decrease sediment loads from current CMP sites by 20%.[7]	Within 5 years of adoption of the Order.
Decrease nitrate loads from current CMP sites by 10%.	Within 10 years of adoption of the Order.

Compliance with the milestones contained in Table 2 of this Order may be demonstrated by showing improvement in relevant water quality concentrations in the surface waters, by showing that there is a reduction in pollutant loading to the surface water, or by showing that there is a reduction in irrigation return flow discharges to the surface water. Current CMP data, or other appropriate data, may be used to set the baseline for showing a decrease in relevant pollutant loadings. If failure to meet these milestones in surface water by the compliance date can be attributed to previously used legacy materials (e.g., nitrates) present in the source water, the milestone will be considered "achieved." Failure to comply with the milestones identified in Table 2 by the compliance date will trigger the need to further update Farm Plans and require implementation of more effective management practices by dischargers who discharge to the surface water in question. Implementation of management practices identified in an updated Farm Plan shall constitute individual discharger compliance with the milestones in Table 2.

Table 3. All Dischargers must comply with the following time schedule and milestones related to nutrients in groundwater.

Milestone	Compliance Date
Implement a proprietary Nutrient Management Plan that is intended to reduce nutrient impacts to groundwater.	Within 1 year from adoption of the Order.
Conduct annual groundwater sampling of one primary groundwater well for nitrates, TDS or EC, and pH. Groundwater	Within 1 year from adoption of the Order, and annually thereafter.

[7] This footnote applies to all three blocks in Table 2, milestones for toxicity, sediment, and nitrates: Reduction in impairment shall be determined by comparing the average of irrigation season (May through September) CMP monitoring results at each CMP site for the year in question to the average base year irrigation season CMP monitoring results for the same site during the CMP monitoring year (e.g., 2009).

sampling must be conducted in the same months each year, as determined by the grower. All results are to be kept in the Farm Plan. Such sampling requirements do not apply to delivered water. If a grower's delivered water sources provide at least annual testing reports for nitrates, TDS, and pH, a grower does not have to conduct individual tests. However, copies of those reports provided by the delivered water sources must be included in the Farm Plan.	

Implementation of a proprietary nutrient management plan identified in an updated Farm Plan, where applicable, shall constitute individual discharger compliance with the milestone in table 3.

G. Schedule

1. Existing Growers seeking to discharge under this Conditional Waiver shall submit an NOI and all corresponding documents within 4 months after adoption of this Order.

2. New Growers not previously enrolled shall file a complete NOI at least 30 days before commencement of the discharge.

H. Definitions

1. Irrigated Lands – lands where water is applied for the purpose of producing commercial crops. For the purpose of this Conditional Waiver, irrigated lands include, but are not limited to, land planted in row, vineyard, field and tree crops, commercial nurseries, nursery stock production, and greenhouse operations with soil floors.

2. Irrigation return flow – surface water which leaves the property following application of irrigation water.

3. Tailwater – the runoff of irrigation water from the lower end of an irrigated field.

4. Stormwater runoff – the runoff of precipitation from the lower end of an irrigated field.

5. Subsurface drainage –water generated by installing drainage systems to lower the water table below irrigated lands. The drainage can be generated by subsurface drainage systems, deep open drainage ditches or drainage wells.

6. Discharge – a release of a waste to waters of the State, either directly to surface waters or through percolation to groundwater. Wastes from irrigated agriculture include earthen materials (soil, silt, sand, clay, rock), inorganic materials (metals, salts, boron, selenium, potassium, nitrogen, phosphorus, etc.), and organic materials such as pesticides.

7. Discharger – the owner and/or operator of irrigated cropland on or from which there are discharges of waste that could affect the quality of any water of the state.

8. Third-Party Entity – Any group of Dischargers, participants, and/or organizations that form to comply with the Conditional Waiver. Coalition Groups can be organized on a geographic basis or can be groups with other factors in common such as commodity groups.

9. Requirement of applicable water quality control plans – a water quality objective, prohibition, Total Maximum Daily Load (TMDL) implementation plan, or other requirement contained in water quality control plans adopted by the Regional Board and approved according to applicable law.

10. Monitoring – refers to all types of monitoring undertaken in connection with determining water quality conditions and factors that may affect water quality conditions, including but not limited to in-stream water quality monitoring undertaken in connection with agricultural activities, monitoring to identify short and long-term trends in water quality, inspections of operations, management practice implementation and effectiveness monitoring, maintenance of on-site records and management practice reporting.

11. Farm Water Quality Management Plan (Farm Plan) – a document that contains, at a minimum, identification of practices that are currently being or will be implemented to address irrigation management, pesticide management, nutrient management and erosion control to protect water quality. Plans will contain a schedule for implementation of practices. Lists of water quality protection practices are available from several sources, including the University of California farm plan template available from the University of California and on-line at http://anrcatalogue.ucdavis.edu/merchant.ihtml?pid=5604&step=4.

12. All other terms shall have the same definitions as prescribed by the California Water Code Division 7, unless specified otherwise.

I. Compliance and Enforcement

1. Growers are the responsible parties for meeting the conditions of this Conditional Waiver. Failure by an Individual Grower to maintain compliance with conditions of this Conditional Waiver may result in enforcement actions including imposition of civil liability under Water Code 13268 or 13350, and/or withdrawal of the

Conditional Waiver and issuance of waste discharge requirements by the Regional Board (Water Code sections 13261, 13263, 13265, 13268, 13300, 13301, 13304, 13340, 13350).

2. Under the terms of this Conditional Waiver, both owners and operators of irrigated lands have responsibility for compliance with the conditions of this Conditional Waiver. Many management practices will be operational in nature and under the direct control of the operator, while structural practices which remain in place through changes in leaseholders will more likely be the responsibility of the landowner. In the event that the Regional Board undertakes enforcement action, the owner and the operator may be held accountable. Owners and operators may consider delineating these responsibilities in lease agreements; however both the owner and operator will retain full legal responsibility for complying with all provisions of this Conditional Waiver.

3. The conditions of this Conditional Waiver require the identification and implementation of targeted actions that will lead to achieving water quality benchmarks. To satisfy the conditions of this Conditional Waiver, an Individual Grower or entity conducting the Cooperative Monitoring Program must submit technical reports, and conduct required monitoring programs. In addition to the foregoing, a Grower must, where necessary to further work toward attaining water quality benchmarks, implement management practices, evaluate the effectiveness of those practices, and, refine and/or supplement those practices to improve their effectiveness, as necessary to attain water quality benchmarks.

4. Individual Growers in compliance with the conditions of this Conditional Waiver will not be required to file ROWDs or be subject to WDRs during the term of this Conditional Waiver.

Submitted on behalf of the following entities that support this proposal:

Kari Fisher

Kari E. Fisher
Associate Counsel
California Farm Bureau Federation
Monterey County Farm Bureau
San Benito County Farm Bureau
San Luis Obispo County Farm Bureau
San Mateo County Farm Bureau
Santa Clara County Farm Bureau
Santa Cruz County Farm Bureau
Santa Barbara County Farm Bureau

James W. Bogart
President & General Counsel
Grower-Shipper Association of Central California

Richard Quandt
President
Grower-Shipper Association of Santa Barbara
and San Luis Obispo Counties

Hank Giclas
Senior Vice President
Science, Technology & Strategic Planning
Western Growers

Kasey Cronquist
CEO/Ambassador
California Cut Flower Commission

Kris O'Connor
Executive Director
Central Coast Vineyard Team

Chris Zanobini
President
California Association of Nurseries and Garden Centers

Rick Tomlinson
Director of Government Affairs
California Strawberry Commission

Daniel Rodrigues
President
Central Coast Wine Growers Association

Michael Scattini
California Artichoke Advisory Board

April Mackie
Farm Programs Manager
Martin Jefferson & Sons

Martin Jefferson
Chair
Central Coast Young Farms and Ranchers

Dale Huss
Vice President of Artichoke Production
Ocean Mist Farms

Michael Scattini
Luis Scattini & Sons

Lisa M. Bodrogi
Government Affairs Coordinator
Paso Robles Wine Country Alliance

Table 1. Nitrate Loading Risk Factor Criteria

A. Crop Type Nitrate Hazard Index Rating
1 - Bean, Grapes, Olive.
2 - Apple, Avocado, Barley, Blackberry, Blueberry, Carrot, Chicory, Citrus, Lemon Oat, Orange, Peach, Pear, Pistachio, Raspberry, Walnut, Wheat.
3 - Artichoke, Bean, Brussel Sprout, Corn, Cucumber, Daikon, Peas, Radish, Squash, Summer, Tomato, Turnip, Squash, Rutabaga, Pumpkin, Potato.
4 - Beet, Broccoli, Cabbage, Cauliflower, Celery, Chinese Cabbage (Napa),Collard, Endive, Kale, Leek, Lettuce, Mustard, Onion, Parsley, Pepper, Spinach, Strawberry.
(Based on UC Riverside Nitrate Hazard Index)

B. Irrigation System Type Rating
1 - Micro-irrigation year round (drip and micro-sprinklers) and no pre-irrigation;
2 - Sprinklers used for pre-irrigation only and then micro-irrigation;
3 - Sprinklers used for germination or at any time during growing season;
4 - Surface irrigation systems (furrow or flood) at any, and/or in combination with any other irrigation system type;
(Based on UC Riverside Nitrate Hazard Index, Adapted for the Central Coast Region)

C. Irrigation Water Nitrate Concentration Rating
1 - Nitrate concentration 0 to 45 mg/liter Nitrate NO3
2 - Nitrate concentration 46 to 60 mg/liter Nitrate NO3
3 - Nitrate concentration 61 to 100 mg/liter Nitrate NO3
4 - Nitrate concentration > 100 mg/liter Nitrate NO3

D. Nitrate Loading Risk Calculation = A x B x C
LOW - Nitrate loading risk is less than 10;
MODERATE - Nitrate loading risk is between 10 and 15;
HIGH - Nitrate loading risk is more than 15.
Note: Dischargers must determine the nitrate loading risk factor for each ranch/farm, based on the criteria associated with the highest risk activity existing at each ranch/farm. For example, the ranch/farm is assigned the highest risk factor, based on the single highest risk crop in the rotation, on one block under furrow irrigation, or on one well with high nitrate concentration.

{Draft} Farm Water Quality Survey

Grower Evaluation of Water Quality

Introduction:

All Growers must complete a Farm Water Quality Survey (FWQS).* The FWQS is to be used as an educational tool for the Grower. The FWQS replaces the current management practices checklist and is a self assessment tool to be completed by each grower. The FWQS is a questionnaire that identifies and demonstrates farm water quality management practices and aids the grower in determining where management practice implementation and educational efforts should be focused.

Upon enrollment, growers are required to submit the FWQS to the Regional Board. In addition, growers may submit an update of the FWQS during the five-year term of the conditional waiver if requested by the Central Coast Regional Water Quality Control Board.

Directions:

Read through the following assessment questions and check the appropriate line to indicate your answer as it pertains to your farm operation. Fill out one questionnaire per contiguous (i.e. adjoining parcels) ranch.

Name of Operation: ______________________________

Operator AW #: ______________

Contact Name: ______________________________

Contact Address: ______________________________

Contact Phone: ______________ Contact Fax: ______________

Contact E-mail: ______________________________

Ranch Name: ______________________________

Ranch Location: ______________________________

Number of Irrigated Acres: ______________________________

1) Do you have Irrigation Water Runoff on this/these ranch(es)?

   Yes ________

   No ________

2) Number of Acres on Ranch with Irrigation Water Runoff: ______________

* Except as exempted with an approved Certificate of Sustainability.

Check Applicable Line

Nutrient Management

1) Annual Crops: Do you know soil residual levels for nitrogen through soil sampling and your crop nitrogen needs?

Yes __________
No __________
N/A __________

2) Perennial Crops: Do you know soil residual levels for nitrogen through soil sampling and your crop nitrogen needs?

Yes __________
No __________
N/A __________

3) Do you know how much nitrogen is in your well or delivered water?

Yes __________
No __________
N/A __________

4) Do you know the total nitrogen required by your crops systems?

Yes __________
No __________
N/A __________

5) Do you incorporate nitrogen quick tests for water and soil into your nutrient management program when appropriate?

Yes __________
No __________

6) Do you use backflow devices on all operating wells?

Yes __________
No __________

7) Do you take into account crop maturation and weather changes when making nitrate application decisions?

Yes __________
No __________

Optional Narrative for Nutrient Management
Please list the question number you are referring to:

____
____
____
____
____
____

Pesticide Management

1) Do you have irrigation return flow (surface water which leaves the property following application of irrigation water)?

   Yes ____________
   No ____________

   Note: If your answer is yes, please answer questions 2-4 in this section. If your answer is no, please skip questions 2-4 in this section.

2) Do you use organophosphate pesticides?

   Yes ____________
   No ____________

   a) Are you in compliance with pesticide label requirements?

      Yes ____________
      No ____________
      N/A ____________

   b) Do you have irrigation water run-off that leaves your property where you use these pesticides?

      Yes ____________
      No ____________
      N/A ____________

      i. If yes, do you use an enzymatic product such as Landguard to remediate the organophosphate pesticide in water runoff?

         Yes ____________
         No ____________
         N/A ____________

      ii. Do you use any other mitigation measures?

Yes ____________
No ____________
N/A ____________

If yes, please describe here:

____
____
____
____
____
____

3) Do you use pyrethroid pesticides?
See sediment management for mitigation answers

Yes ____________
No ____________
N/A ____________

a) Are you in compliance with pesticide label requirements?

Yes ____________
No ____________

4) If you have irrigation water run-off, have you utilized SMART SAMPLING, or conducted your own sampling to determine if management practices result in water quality improvements?

Yes ____________
No ____________
N/A ____________

5) Are you a licensed Pesticide Crop Advisor or do you hold a Qualified Applicator License?

Yes ____________
No ____________
N/A ____________

If N/A, please explain:

____
____

Optional Narrative for Pesticide Management

Please list the question number you are referring to:

____

____

____

____

____

____

Sediment Management

1) Do you have irrigation water run-off that leaves your property?

Yes ____________

No ____________

N/A ____________

2) Do you have soil sediment leaving your fields from irrigation?

Yes ____________

No ____________

N/A ____________

3) If yes, do you use a sediment basin to retain and settle sediments prior to discharging irrigation water run-off?

Yes ____________

No ____________

N/A ____________

4) Do you use PAM to control sediment?

Yes ____________

No ____________

N/A ____________

5) Do you control sediment from leaving fields with any of the following management practices? *Please check the methods you use.*

- ☐ Cover Crops
- ☐ Mulching
- ☐ Filter Strips

- ☐ Vegetated buffers
- ☐ Vegetated Ditches
- ☐ Sediment Basins
- ☐ Other (please describe in narrative)

Optional Narrative for Sediment Management
Please list the question number you are referring to.

____
____
____
____
____
____

Groundwater & Irrigation Management

8) Do you have irrigation water run-off?

   Yes ____________
   No ____________

9) Are you monitoring your soil moisture level?

   Yes ____________
   No ____________

10) Have you taken steps toward determining and understanding your irrigation distribution uniformity?

   Yes ____________
   No ____________

11) Are there back-flow devices on your wells?

   Yes ____________
   No ____________

Optional Narrative for Irrigation & Groundwater Management
Please list the question number you are referring to:

____
____
____
____

Draft Central Coast Agriculture's Alternative Proposal for the Regulation of Discharges from Irrigated Agricultural Lands
Draft Monitoring and Reporting Program for the Cooperative Monitoring Program
December 3, 2010

Water Code section 13267 and 13269 authorizes the Central Coast Regional Water Quality Control Board to require preparation and submittal of technical and monitoring reports. This draft Monitoring and Reporting Program (MRP) sets forth monitoring and reporting requirements for the third-party entity conducting the Cooperative Monitoring Program under the Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands (see Draft Central Coast Agriculture's Alternative Proposal for the Regulation of Discharges from Irrigated Agricultural Lands).

Monitoring and Reporting Requirements

Table 1. Receiving Water Quality Monitoring Parameters

Parameters and Tests	**RL[1]**	**Monitoring Frequency[2]**
Photo Monitoring		
Photograph of monitoring location		With every monitoring event
WATER COLUMN SAMPLING		
Physical Parameters and General Chemistry		
Flow (field measure (CFS)	.25	Monthly, plus 2 stormwater events
pH (field measure)	0.1	"
Electrical Conductivity (field measure) (uS/cm)	2.5	"
Dissolved Oxygen (field measure) (mg/L)	0.1	"
Temperature (field measure) (^{0}C)	0.1	"
Turbidity (NTU)	0.5	"
Total Dissolved Solids (mg/L)	10	"
Total Suspended Solids (mg/L)	0.5	"
Hardness (mg/L as CaCO3)	1	"
Total Organic Carbon (ug/L)	0.6	"
Nutrients		
Total Kjeldahl Nitrogen (mg/L)	0.5	Monthly, plus 2 stormwater events
Nitrate + Nitrite (as N) (mg/L)	0.1	"
Total Ammonia (mg/L)	0.1	"

[1] Reporting Limit, taken from SWAMP where applicable.
[2] Monitoring is ongoing through all five years of the Order, unless otherwise specified. Monitoring frequency may be used as a guide for developing alternative MRP Plan.

Parameters and Tests	**RL**[3]	**Monitoring Frequency**[4]
Unionized Ammonia (calculated value, mg/L))		
Total Phosphorous (as P) (mg/L)	-	"
Soluble Orthophosphate (mg/L)	0.01	"
Water column chlorophyll a (ug/L)	0.002	Monthly only
Floating Algal Mats, % coverage	-	Monthly only
Pathogens		
Fecal coliform (MPN/100 ml)	2	Quarterly, plus 2 stormwater events
E. coli (MPN/100 ml)	2	"
Water Column Toxicity Test		
Algae – *Selenastrum capricornutum*, 4 day	-	Twice in dry season, twice in wet season
Water Flea – *Ceriodaphnia (7-day chronic)*	-	"
Fathead Minnow – *Pimephales promelas (7-day chronic)*	-	Twice in dry season, twice in wet season
Pesticides[5] **(ug/L)**		
Carbamates		
Aldicarb	0.05	4 times, concurrent with water toxicity monitoring, in second year of Order term
Carbaryl	0.05	"
Carbofuran	0.05	
Methiocarb	0.05	"
Methomyl	0.05	"
Oxamyl	0.05	"
Organophosphate		
Pesticides		
Azinphos-methyl	0.05	"
Chlorpyrifos	0.05	"
Diazinon	0.05	"
Dichlorvos	0.05	"
Dimethoate	0.05	"
Dimeton-s	0.05	"
Disulfoton (Disyton)	0.05	"

[3] Reporting Limit, taken from SWAMP where applicable.
[4] Monitoring is ongoing through all five years of the Order, unless otherwise specified. Monitoring frequency may be used as a guide for developing alternative MRP Plan.
[5] Pesticide list may be modified based on specific pesticide use in Central Coast Region.

Parameters and Tests	**RL**[6]	**Monitoring Frequency**[7]
Malathion	0.05	"
Methamidophos	0.05	"
Methidathion	0.05	"
Parathion-methyl	0.05	"
Phorate	0.05	"
Phosmet	0.05	"
Herbicides		
Altrazine	0.05	"
Cyanazine	0.20	"
Diuron	0.05	"
Glyphosate	2.0	"
Linuron	0.1	"
Paraquat dichloride	4	"
Simazine	0.05	"
Trifluralin	0.05	"
Other (ug/L)		
Phenol	10	4 times, concurrent with water toxicity monitoring, in second year of Order term
<u>SEDIMENT SAMPLING</u>		
Sediment Toxicity – Hyalella azteca 10-day		Annually
Benthic invertebrate Assessment	SWAMP SOP	Once during the second year of Order concurrent with sediment toxicity sampling
Pyrethroid Pesticides in Sediment (ug/kg)		
Gamma-cyhalothrin	25	Once during second year of Order, concurrent with sediment toxicity sampling
Lambda-cyhalothrin	25	"
Bifenthrin	25	"
Delta-Methrin	25	"
Beta-cyfluthrin	25	"
Cyfluthrin	25	"
Esfenvalerate	25	"

[6] Reporting Limit, taken from SWAMP where applicable.
[7] Monitoring is ongoing through all five years of the Order, unless otherwise specified. Monitoring frequency may be used as a guide for developing alternative MRP Plan.

Parameters and Tests	**RL**[8]	**Monitoring Frequency**[9]
Permethrin	25	"
Cypermethrin	25	"
Organochlorine Pesticides in Sediment		
DDD	2	"
DDE	2	"
DDT	5	"
Dicofol	2	"
Dieldrin	2	"
Endrin	2	"
Methoxychlor	5	"
Other		
Chlorpyrifos (ug/L)	2	"
Total Organic Carbon	0.01%	"
Sediment Grain Size Analysis	1%	Once during second year of Order, concurrent with sediment toxicity sampling

Table 2. Groundwater Sampling Parameter

Parameter	**RL**	**Analytical Method**	**Units**
pH	0.1	Field or Laboratory Measurement EPA General Methods	pH Units
Specific Conductance	2.5		µS/cm
Total Dissolved Solids	10		mg/L
Nitrate + Nitrite (as N)	0.1	General Anions EPA Method 300	mg/L

[8] Reporting Limit, taken from SWAMP where applicable.
[9] Monitoring is ongoing through all five years of the Order, unless otherwise specified. Monitoring frequency may be used as a guide for developing alternative MRP Plan.

Table 3. Individual Discharge Monitoring for Tailwater and Stormwater Discharges

Parameter	Analytical Method[10]	Maximum PQL	Units	Min Sampling Frequency
Discharge Flow or Volume	Field Measure	---	CFS	(a) (d)
Approximate Duration of Flow	Calculation	---	hours/month	
Temperature (water)	Field measure	0.1	^{0}Celsius	
pH	Field Measure	0.1	pH units	
Turbidity	SM 2130B, EPA 180.1	1	NTUs	
Nitrate + Nitrite (as N)	EPA 300.1, EPA 353.2	0.1	mg/L	
Ammonia	SM 4500 NH3, EPA 350.3	0.1	mg/L	
Chlorpyrifos[11]	EPA 8141A, EPA 614	0.02	ug/L	(b) (c) (d)
Diazinon[12]				
Algae Toxicity (Selanastrum)	EPA-821-R-02-013	NA	% Survival	
Ceriodaphnia Toxicity (96-hr acute)	EPA-821-R-02-012			
Chlorpyrifos[11]	EPA 8141A, EPA 614	0.02	ug/L	
Diazinon[12]				
Algae Toxicity (Selanastrum)	EPA-821-R-02-013	NA	% Survival	

[10] "Quick test strips" and handheld water quality meters may be used if method or device is approved by EPA and appropriate sampling methodology and quality assurance protocols are used to ensure accuracy of the test.
[11] If chlorpyrifos or diazinon is used at the farm/ranch, otherwise does not apply.
(a) Two times per year during primary irrigation season for operations greater than 1000 acres but less than 5000 acres, and four times per year during primary irrigation season for operations grater than 5000 acres.
(b) Once per year during primary irrigation season for operations greater than 1000 acres but less than 5000 acres, and two times per year during primary irrigation season for operations greater than 5000 acres.
(c) Sample must be collected within one week of chemical application, if chemical is applied on farm/ranch.
(d) Once per year during wet season (October – March) for operations greater than 1000 acres but less than 5000 acres, and two times per year during wet season for operations greater than 5000 acres, within 18 hours of major storm events.
[12] If chlorpyrifos or diazinon is used at the farm/ranch, otherwise does not apply.

Exhibit 25

University of California
Center for Water Resources

Nitrate Groundwater Pollution Hazard Index

Water Quality Program - Nitrate Groundwater Pollution Hazard Index

Find your index number

Purpose: To provide information for farmers to voluntarily target resources for management practices that will yield the greatest level of reduced nitrogen contamination potential for groundwater by identifying the fields of highest intrinsic vulnerability.

How it Works: The index works with an overlay of soil, crop, and irrigation information. Based on the three components, an overall potential hazard number is assigned and management practices are suggested where necessary. If you don't know what soil type you have, try this online soil survey with detailed soil survey data for much of California, Arizona, and Nevada.

More Information:

- Hazard Index Concept (background information & process) (pdf, 54kb)
- Supporting Evidence for the Nitrate Groundwater Pollution Hazard Index Concept (pdf, 49kb)
- Concentration versus Mass Flow (pdf, 61kb)
- Irrigation Principles (pdf, 49kb)
- Dynamics of Nitrogen Availability and Uptake (pdf, 124kb)
- Basic Factors Affecting N Transport through Soils (pdf, 107kb)
- Interpretation of Nitrate Groundwater Pollution Hazard Index Number (pdf, 42kb)
- Workshop Presentations:
  - Background Information and Supporting Evidence for the Hazard Index (pdf, 154kb)
  - Basic Factors Affecting N Transport through Soils (pdf, 263kb)
  - Hazard Index Ratings for Soils: Methodology and Examples (pdf, 78kb)
  - Hazard Index Ratings for Crops: Methodology and Examples (pdf, 381kb)
  - Hazard Index Ratings for Irrigation Systems (pdf, 168kb)

Agriculture and Natural Resources, University of California

Webmaster Email: djkrause@ucdavis.edu

Notice: A session had already been started - ignoring session_start() in **E:\Websites\hazardindex\wrc\header.php** on line **3**

for Irrigated Agriculture in the Southwest

Admin

Notice: Undefined index: logged_in in E:\Websites\hazardindex\wrc\header.php on line 22

Home Find Your Index Number

Notice: Undefined index: submit in **E:\Websites\hazardindex\wrc\search2.php** on line **100**

Notice: Undefined variable: HTTP_GET_VARS in **E:\Websites\hazardindex\wrc\search2.php** on line **100**

Crop	Strawberries
Soil *	salinas
Irrigation	micro-irrigation system w/fertigation
Deep Rip	None

Search

* Lookup your Soil Type

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HI NO_3^- for Irrigated Agriculture in the Southwest

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Home   Find Your Index Number

Notice: Undefined index: logged_in in E:\Websites\hazardindex\wrc\header.php on line 22

Your Hazard Index (HI) is 12.
Please see table below to assess your relative risk of contaminating groundwater.

An HI of 1 to 20 is of relatively minor concern. The grower should use sound management practices but extraordinary procedures are not required. However, an HI greater than 20 should receive careful attention.

As can be seen in the table on the right, agricultural fields with soils rated 4 or 5 often have HI's of greater than 20 and should be managed to reduce the risk of groundwater contamination. Soils rated 1 or 2 generally have HI's that range between 1 and 20 and can be cultivated with more latitude in the choice of crop and irrigation system.

To view other crops with your rating (4) click here.

	Soil					
Crop	1	2	3	4	5	Irrigation
1	1	2	3	4	5	1
1	2	4	6	8	10	2
1	3	6	9	12	15	3
1	4	8	12	16	20	4
2	2	4	6	8	10	1
2	4	8	12	16	20	2
2	6	12	18	24	30	3
2	8	16	24	32	40	4
3	3	6	9	12	15	1
3	6	12	18	24	30	2
3	9	18	27	36	45	3
3	12	24	36	48	60	4
4	4	8	$\boxed{12}$	16	20	1
4	8	16	24	32	40	2
4	12	24	36	48	60	3
4	16	32	48	64	80	4

The hazard rating for the production of Strawberries is high ('4') because

Notice: Use of undefined constant Shallow - assumed 'Shallow' in **E:\Websites\hazardindex\wrc\search2.php** on line **224**

- nitrate is likely to quickly move beneath the shallow roots of this crop

Notice: Use of undefined constant Moderate - assumed 'Moderate' in **E:\Websites\hazardindex\wrc\search2.php** on line **226**

Notice: Use of undefined constant Deep - assumed 'Deep' in **E:\Websites\hazardindex\wrc\search2.php** on line **228**

Notice: Use of undefined constant Low -

assumed 'Low' in **E:\Websites\hazardindex\wrc\search2.php** on line **230**

Notice: Use of undefined constant Medium - assumed 'Medium' in **E:\Websites\hazardindex\wrc\search2.php** on line **232**

Notice: Use of undefined constant High - assumed 'High' in **E:\Websites\hazardindex\wrc\search2.php** on line **234**

Notice: Use of undefined constant Low - assumed 'Low' in **E:\Websites\hazardindex\wrc\search2.php** on line **236**

Click here for suggested practices to mitigate problematic crop characteristics.

Notice: Use of undefined constant Medium - assumed 'Medium' in **E:\Websites\hazardindex\wrc\search2.php** on line **238**

- a moderate proportion of the N concentrated within plant tissues is removed during harvest, leaving some atop the soil in crop residue and available for leaching

Notice: Use of undefined constant High - assumed 'High' in **E:\Websites\hazardindex\wrc\search2.php** on line **240**

Hazard rating for your soil type (Salinas): 3.

Click here for soil characteristics associated with this rating

Hazard rating for Micro-irrigation system w/fertigation: 1.

Click here to see a description of this irrigation method.

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UC Center for Water Resources

HI NO_3^- for Irrigated Agriculture in the Southwest

THE HAZARD INDEX CONCEPT

A supporting document for the
UC Center for Water Resources (http://www.waterresources.ucr.edu)
Nitrate Groundwater Pollution Hazard Index

The United States Congress appropriated funds to the US Geological Survey (USGS) to begin the National-Water Quality Assessment (NWQA) Program in 1991. As part of the NWQA Program the USGS works with other federal, state and local agencies to understand the spatial extent of water quality, how water quality changes with time and how human activities and natural factors affect water quality across the nation. The USGS published a report (USGS 1999) entitled, "The Quality of Our Nation's Waters" with specific reference to nutrients and pesticides. For the purposes of our report, we will only address nitrogen issues.

Some of the highest levels of nitrogen were reported to occur in streams and groundwater in agricultural areas. However, concentrations were found to vary considerably from season to season as well as among watersheds. A graphical plot of nitrogen inputs to agricultural land versus median nitrate concentrations in underlying shallow groundwater produced a complete scatter of points (USGS 1999, p 47). The range of nitrate concentrations was the same for all levels of nitrogen input. Differences in natural features and land management practices make some areas more vulnerable to contamination than other areas. Recognition of differences in vulnerability to contamination can help target the appropriate level of protection and monitoring to major aquifers at greatest risk. The most extensive control strategies should be considered in the more vulnerable settings.

Nolan (2001) used multi variant logistic regression models based on more than 900 sampled wells to predict the probability of exceeding 4 mg/L of nitrate in ground water in the United States. The model consisted of 6 variables: nitrogen fertilizer loading, percent crop land-pasture, natural log of population density, percent well-drained soils, depth to seasonally high water table, and presence or absence of a fracture zone within an aquifer. Although valuable at the large landscape scale, the results are not useful on a farm level scale where management decisions are made which could affect ground water degradation from nitrogen. Nevertheless, the concept of establishing vulnerability to groundwater contamination is valid and even more appropriate on a farm scale.

Estimates of groundwater vulnerability can be separated into intrinsic vulnerability and specific vulnerability (National Research Council, 1993). Intrinsic vulnerability is related to factors of which the farmer has no control such as the hydrologic properties of the soil and hydrogeologic factors such as proximity of an aquifer to land surface, etc. Although the farmer can choose the crop to grow, the choice is usually made on economic factors. Once a crop is chosen, each crop has an intrinsic vulnerability for groundwater contamination from nitrates. Likewise, irrigation systems may be selected, but each irrigation system has an intrinsic vulnerability. Specific vulnerability is a function of management factors such as quantity, rate, timing, and methods of nitrogen and water application and other agricultural management practices. Therefore, the farmer has some level of control over the specific vulnerability with little or no control over the intrinsic vulnerability.

The National Academy of Science Water Science and Technology Board appointed a committee on Techniques for Assessing Groundwater Vulnerability. The committee defined groundwater vulnerability as: "The tendency or likelihood for contaminants to reach a specified position in the groundwater system after introduction at some location above the uppermost aquifer." They pointed out that this definition of groundwater vulnerability is flawed, as is any other, by a fundamental principle that they stated as the First Law of Groundwater Vulnerability: "All groundwater is vulnerable." They also proposed a Second Law of Groundwater Vulnerability: "Uncertainty is inherent in all vulnerability assessments."

The committee suggested a vulnerability assessment process. The first step is to identify the purpose of the assessment. The next step is to select a suitable approach for conducting the assessment. They listed three methods of assessment: 1) overlay and index methods, 2) methods using process-based simulation models, and, 3) statistical methods. The report elaborated on each of these methods. We will follow the proposed steps by stating the purpose and then describing the assessment method.

PURPOSE: To provide information for farmers to voluntarily target resources for management practices that will yield the greatest level of reduced nitrogen contamination potential for groundwater by identifying the fields of highest intrinsic vulnerability.

ASSESSMENT METHOD: We used the overlay and index method. Although process-based simulation models were not specifically used, the basic physical and chemical factors that are incorporated into these models were used in deriving an index number. The overlay consists of soil maps, crop and irrigation system distributions. The soils, crops and irrigation systems were each indexed by an approach described below.

This approach is consistent with the recommendations of a Nutrient Technical Advisory Committee (TAC) appointed by the California State Water Resources Control Board. The TAC was assigned to propose a nutrient management approach in California that would meet the varied interests of those who have a stake in the quality of California's waters. The TAC proposed that farmers complete a hazard index for each field on their farm based on the soil, crop and irrigation systems. The TAC proposed that the soil be assigned a hazard value of 1, 2 or 3. Soils classified as 1 are those that have textural or profile characteristics that inhibit the flow of water and create an environment conducive to denitrification. Both denitrification and restrictive water flow decrease the migration of nitrate to groundwater. Conversely those soils classified as 3 are most sensitive to groundwater degradation by nitrate because of the high water infiltration rates, high transmission rates through their profile, and low denitrification potential. In our case, we expanded the hazard values to 1 through 5, but used the same criteria as proposed by TAC for assigning higher or lower hazard values.

The TAC proposed that crops be classified into three hazard indices based on their degree of potential for nitrate leaching. They suggested that those with the highest potential for nitrate leaching, which would have a hazard index of 3, are those with the following characteristics: (1) The nitrogen uptake in the crop is a small fraction of the total nitrogen applied to the crop; (2) the crop requires high nitrogen input and frequent irrigation to ensure rapid vegetative growth; (3) the value of the crop is such that there is a tendency to add excess nitrogen to ensure no nitrogen deficiencies; (4) the crop is not adversely affected when more than adequate amounts of nitrogen are applied; and (5) the crop has a shallow root system where a small amount of water movement could carry nitrate below the root system. Crops with the opposite characteristics of those listed would have a low potential for nitrate leaching and have a hazard index of 1. Crops with intermediate characteristics would be classified with a hazard index of 2.

The criteria that we used in assigning a hazard index for crops were consistent with those suggested by TAC, but differed in detail. We also expanded the crop hazard index to 1 through 4. The factors considered in establishing a hazard index for field crops and vegetables were as follows: 1) rooting depth, 2) ratio of N in the crop tops to the recommended N application, 3) fraction of the crop top N that is removed from the field in the marketed product, 4) the magnitude of the peak N uptake rate, and 5) whether the crop is harvested at a time when N uptake rate is high. A slightly modified set of criteria was used for tree and vine crops. The rooting depth is quite great in all cases and none is harvested at the time of peak N uptake rate. Therefore, these criteria were eliminated and replaced by the magnitude of leaf N deposit for trees and vines.

The crops with a shallower rooting depth have a higher potential for N leaching than deep-rooted crops. Crops that take up a high percentage of the recommended N application provide for a lower hazard for N leaching than those which take up a low percentage, thus leaving much N in the soil. Furthermore, removal of much of the N in the crop tops with the harvested product creates a lower hazard than when the crop residues containing much N are left on the field. Crops that have a very high peak N uptake rate over a short period are considered to be more hazardous than those with low peak N uptake rate because they require large quantities of mineral N to be available for that time period.

A matrix was constructed for each crop and the criteria used to establish the hazard index. The hazard index number that was chosen for each crop was based on an overall consideration of all the criteria. For example, lettuce has a hazard index of 4 because it is shallow rooted, is harvested at the time of peak uptake rate, and much of the N in the tops remains in the field. Conversely, alfalfa has a hazard index of 1 because it is deep rooted and nitrogen fertilizer application is not required. The matrix, as well as the hazard index number, will be reported for each crop.

The TAC recommended that the irrigation system be classified into a hazard index of 0 through 3. The "0" hazard index is a micro-irrigation system accompanied by fertigation. Small amounts of water and nutrients can be frequently applied in quantities to match the crop need. A micro irrigation system without fertigation is assigned a hazard index of 1. Sprinklers used throughout the irrigation season or for pre-irrigation for crop establishment is assigned a hazard index of 2. Entire surface irrigation systems such as furrow are assigned a hazard index of 3. We used the same criteria for indexing irrigation systems except that our range was 1 through 4 rather than 0 through 3.

In our case, the overlay and index method consists of having an overlay of the soil, crop and irrigation system maps and multiplying the hazard index numbers for each. The intrinsic hazard index number can range from 1 through 80. The TAC suggested adding the index numbers. Adding the numbers would provide a much smaller range between 3 and 13, which would consequently make it more difficult to distinguish the relative hazards among combinations of soils, crops, and irrigation systems.

Although the TAC proposed that farmers complete a hazard index for each field, the proposal has never been implemented. A major impediment to the implementation is that soils and crops have not been assigned hazard rating values. We have developed tables of hazard rating numbers for the major irrigated soils and crops in Arizona, California, and Nevada that can be used by farmers to assess the relative hazard for groundwater degradation by nitrate for each of their fields.

References:

National Research Council. 1993. Ground water vulnerability assessment – Predicting relative contamination potential under conditions of uncertainty. National Academy Press, Washington, DC.

Nolan, B. T. 2001. Relating nitrogen sources and aquifer susceptibility to nitrate in shallow ground waters of the United States. Ground Water, 39(2):290-299.

USGS. 1999. The Quality of our Nation's Waters. U.S. Geological Survey Circular 1225.

Photo Monitoring and Reporting Protocol
Established by the Executive Officer

Exhibit 26

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for **Kenneth Harris, Jr., Interim Acting Executive Officer**
Revised August 15, 2012

Requirement for Photo Monitoring and Reporting

The Agricultural Order, No. R3-2012-0011 (Part E, ¶ 69, Page 28), and the associated Monitoring and Reporting Program (MRP), Orders No. R3-2012-0011-02 (Part 4A, ¶ 1- 2, Page 14) and R3-2012-0011-03 (Part 4A, ¶ 1-2, Page 14 and Part 7A, ¶ 1-2, Page 20-21), require dischargers to conduct Photo Monitoring and Reporting. The requirement to conduct Photo Monitoring and Reporting applies to Tier 2 and Tier 3 dischargers whose properties contain or are adjacent to a waterbody identified on the 2010 Clean Water Act section 303(d) List of Impaired Waterbodies for temperature, turbidity or sediment.

The Order requires Tier 2 and Tier 3 dischargers to 1) document the condition of perennial, intermittent, or ephemeral streams and riparian wetland area habitat, 2) conduct Photo Monitoring consistent with these protocols established by the Executive Officer, and 3) demonstrate how practices in the photos meet the Basin Plan requirements for Erosion and Sedimentation (Chapter 5, p. V-13, Section V.G.4), including relevant management practices and/or treatment and control measures implemented to prevent conditions, erosion, or sediment discharges that may or do cause or contribute to impairments for temperature, turbidity, or sediment. The Executive Officer may request additional photographs if needed.

The Order requires Tier 2 dischargers to conduct Photo Monitoring and Reporting every four years, at the same photo monitoring point locations, and to submit the photos and associated reports in a format specified by the Executive Officer.

The Order further requires Tier 3 dischargers to implement the same requirements as Tier 2. The MRP Order R3-2012-0011-03 (Part 7A, ¶ 1-2, Page 20-21) further requires Tier 3 dischargers to conduct Photo Monitoring and Reporting annually to document progress on their Water Quality Buffer Plan which is due 2016 (Agricultural Order R3-2012-0011, Part F, ¶ 80-81, Page 30-31).

This protocol describes how to conduct Photo Monitoring and Reporting to meet these requirements.

Methodology for Photo Monitoring

1. Establish Photo Monitoring Points

Place a permanent marker in view of the photo monitoring point if a natural marker (i.e. fencepost or large tree) does not exist. A permanent marker is necessary for a) property owners to ensure that the same location is used for the photo point every four years and b) Water Board Staff to compare the view in subsequent photos taken from the same location.

2. Document Monitoring Points.

Label each photo monitoring point with a unique site code (Global ID # & Photo Point #). Identify the exact location of each photo monitoring point on a ranch map, identified with the unique site code. See additional detailed description below in **Methodology for Documentation and Reporting**.

3. Establish In-stream Condition Photo Monitoring Points

Establish photo monitoring points to document in-stream riparian condition at the upstream and downstream boundaries of the stream, wetland or other waterbody. Include banks of the stream, wetland or waterbody that are adjacent to the ranch property (Diagram 1). If one photo point is not visible from the other (due to a significant bend in the waterbody) or there is more than ½ mile of stream length between photo points, additional photo points must be established (Diagram 2).

In-stream photo monitoring point 001

Establish a permanent photo monitoring point at the downstream most edge of the waterbody on the ranch property. Mark the location with a permanent marker that will be visible in the photo if one does not already exist (such as a large tree or fence post). Position the monitoring point on the top of the bank of the waterbody. Take a minimum of one photo from this monitoring point looking upstream. In this photo, the following should be visible: permanent marker, center of riparian area, waterbody bank, top of bank and vegetation on adjacent non-cropped areas such as a road (Figure 1). Multiple photos may be taken so that they can be overlaid and show all of the above from photo point 001. If multiple photos must be taken at a given photo monitoring point, they shall be labeled with the site point number and letters a-z (i.e.001a, 001b, 001c etc).

In-stream photo monitoring point 002

Establish a permanent photo monitoring point at the upstream most edge of the waterbody on the ranch property. This monitoring location should also be marked with a permanent marker. Position the monitoring point on the top of the bank of the waterbody. Take a minimum of one photo from this monitoring point, looking downstream. Again the following should be visible in the photo: permanent marker, center of riparian area, waterbody bank, top of bank and vegetation on non-cropped areas such as unpaved roads (Figure 1).

Figure 1. Example of in-stream photo 001. This photo shows the permanent marker (orange post), center of waterway, waterbody bank, top of bank and vegetation on non-cropped areas.

Diagram 1. Location of In-stream Condition Photo Monitoring Points.

If there is a significant bend in the waterbody or the ranch has more than ½ mile of stream length, additional photo monitoring points must be established (as shown in Diagram 2). From each of the points, two photos must be taken. The first photo must be taken facing upstream and the second facing downstream. Again, the following should be visible in each photo: center of riparian area, waterbody bank, top of bank and vegetation on non-cropped areas such as unpaved roads. For a ranch like the one shown in Diagram 2, five in-stream photo monitoring points must be established to adequately document the conditions and riparian habitat on the stream banks and in the stream.

Diagram 2. Additional in-stream condition monitoring points (if needed).

4. Riparian Vegetation Condition Photo Monitoring Points

Establish photo monitoring points to document riparian vegetation condition at a minimum of three locations on the ranch property, positioned 100 feet back from the riparian vegetation edge (and into the fields). Establish the first photo monitoring point at the downstream edge of the waterbody and ranch property. Establish the second point mid-ranch (mid-way between the up and downstream edges). Establish the final photo monitoring point at the upstream most edge of the ranch property. If one edge of the ranch is not visible from the other edge (due to a significant bend in the waterbody), or the ranch has more than ½ mile of stream length, additional photo points must be established.

Riparian vegetation condition photo monitoring point 003 (NOTE: start numbering with three if only two photo points were established for in-stream condition as shown in Diagram 1; otherwise, start numbering consecutively from last in-stream condition photo monitoring point number.)
Establish the photo monitoring point at the upstream edge of the ranch/waterbody and 100 feet away from the top of the waterbody bank (into the field). Face downstream but at a 45-degree angle to the riparian area and take one picture. In this photo, the following should be visible: the upstream edge of the property/waterbody, midpoint of the property/waterbody, the ground adjacent to the riparian vegetation and the riparian vegetation looking downstream. Diagram 3 illustrates the photos needed for each riparian vegetation photo monitoring point.

Riparian vegetation condition photo monitoring point 004 (See NOTE above re: number)
Establish the photo monitoring point at a midpoint between the upstream and downstream edges of the ranch/waterbody. Again, this photo monitoring point must be on the field and 100 feet away from the top of the waterbody bank. From this point take three photos: 1) facing downstream, at a 45-degree angle (photo 004dn), 2) facing directly toward the riparian vegetation (photo 004), and 3) facing upstream, at a 45 degree angle (photo 004up). If there is a significant bend in the waterbody and the edge of the ranch is not visible from this point, establish additional photo points moving downstream and repeat this procedure (Diagram 4). Establish the monitoring points so that the view in one picture slightly overlaps with the next point.

Riparian vegetation condition photo monitoring point 005 (See NOTE above re number) Establish the photo monitoring point at the downstream edge of the ranch/waterbody and on the field, 100 feet away from the top of the waterbody bank. Face upstream but at a 45 degree angle to the riparian area and take one picture. In this photo, the following should be visible: downstream edge of the property/waterbody, midpoint of the property/waterbody, ground adjacent to the riparian vegetation and riparian vegetation looking upstream.

Diagram 3. Top of diagram is upstream from bottom of diagram. Photographer is positioned 100 feet back from the water's edge, standing in the field.

Diagram 4. Additional riparian vegetation condition monitoring points (if needed).

5. Photos Documenting Management Practices

Additional photos must be submitted to document any management practices and/or treatment and control measures used to prevent conditions, erosion or sediment discharges that may or do cause or contribute to impairments for temperature, turbidity, or sediment. There is no specific photo monitoring protocol for photos documenting additional management practices or measures that are not located at established photo monitoring points. However, any photos taken to document management practices or measures must be reported with a brief form to identify the location and type of practice or measure. Label photos documenting additional management as described below in the Methodology and Documentation for Reporting section.

Methodology for Documentation and Reporting

Dischargers will maintain photo monitoring point data, including a map showing exact locations of each photo monitoring point, photos and completed photo reporting forms, in their Farm Plan. Discharges will submit photo monitoring point data upon request of the Executive Officer. Dischargers must maintain the following information in the format specified below.

1. Ranch map showing exact location of each photo monitoring point and including:
   - Points showing the location of each photo monitoring point
   - Labels for each photo monitoring point (unique site code)
   - Map scale
   - North marker
   - Landmarks such as labeled road crossings and waterways.

2. Photos- Labeling, Mapping and Describing
   - In-stream and riparian vegetation condition photos must be labeled to include the following information:
     - Unique site code (Global ID # & Photo Point #)
       - Note, Global ID appears on the ranch information page as follows: "Global ID: AGL##########"
     - Photo Date (Formatted: DayMonthYear or 05May2012)
   - Each in-stream or riparian condition photo must be labeled with this format: Global ID #_Site#_Date.jpg. For example, a photo taken at site 003 on Global ID # 1234 on May 5th 2012 would have the following label: AGL1234_003_5May2012.jpg
   - Additional management practice photos must be labeled as follows: Global ID #_MP_###_Date.jpg. For example, If two practices are documented with photos, on Global ID # 1234 taken on May 5th 2012, Photos must have the following labels: AGL1234_MP001_5May2012.jpg and AGL1234_MP002_5May2012.jpg
   - All photos must be one of the following formats (JPEG, GIF, TIFF or BMP)
   - If possible, use a camera with a GPS feature (such as smart phones or tablets) so that the coordinates of the photo locations are automatically associated with the picture file.

3. Photo Documentation Reporting Forms
   - Each photo must be delivered with a photo documentation form (Attachment 1, available in word format at:

http://www.waterboards.ca.gov/centralcoast/water_issues/programs/ag_waivers/index.shtml, See link under "Grower Workshops and Resources."). Each form records the following data and information about a single photo: Photo monitoring point data including AGL#, waterbody name, purpose of the photo, photo monitoring point #, coordinates and date.
- Explanations and descriptions of the management practices demonstrated in the photos (if applicable)
- Estimated widths of buffer and riparian areas from top of bank (top edge of water holding capacity for the waterbody) to the edge of either cropped area or non-cropped areas like roads, whichever is closer. This should be an estimate of the average width for the view in the photo.

4. Reporting:
   - Dischargers are NOT required to submit the map, photos or photo documentation forms to the Central Coast Water Board.
   - All photos and photo documentation forms must be *maintained in the farm plan* as of October 1, 2012.
   - Dischargers must conduct the same photo monitoring procedures and documentation, and add the items in 1-3 above to the farm plan again in four years, by October 1, 2016.
   - Photo monitoring documentation must be submitted to the Water Board upon request of the Executive Officer.
   - Dischargers must indicate on the Annual Compliance Form Section K, if and when they have completed the documentation required as in 1-3 above and added it to the farm plan as required.

Definitions

Riparian vegetation or vegetated cover- the naturally occurring vegetation found along creek channels, typically willows and other trees, shrubs, and grasses.

Width of vegetated cover- the width measured or estimated for each bank from top of bank to edge of vegetation.

Right bank- bank on the right while the observer is facing downstream.

Left bank- bank on the left while the observer is facing downstream.

References

Hall. F.C. March 2002. Photo Point Monitoring Handbook: Part A-Field Procedures. U.S. Department of Agriculture, Forest Service. Portland, OR.

Photo Monitoring and Reporting Protocol

ATTACHMENT 1

Photo Documentation Reporting Form
(Use one form for each photo taken.)

This Form is available in word format at:
http://www.waterboards.ca.gov/centralcoast/water_issues/programs/ag_waivers/index.shtml,
See link under "Grower Workshops and Resources."

Global ID (AGL) #: ______________ Photo Monitoring Point #:____________

Photo Point Coordinates (NAD 83): Latitude:_________Longitude:__________

Waterbody Name: _________________________ Photo Date: _____________

Description of the photo monitoring point purpose and view in each photo (Choose one)

In-stream condition(photo on bank)
Riparian vegetation condition (photo 100 ft back from bank)

1. Identify Management Practice(s) Demonstrated in Photo (Choose One or more of the following).

Maintain vegetative cover (Herbaceous plants)
Maintain vegetative cover (small woody plants, < 15 ft tall)
Maintain vegetative cover (large woody plants , >15 ft tall)
Plant vegetative cover, filter or buffer strip (Herbaceous plants)
Plant vegetative cover, filter or buffer strip (small woody plants, < 15 ft tall)
Plant vegetative cover, filter or buffer strip (large woody plants , >15 ft tall)
Vegetative treatment system
Seeding (hydro seed or hydraulic planting)
Rolled Erosion Control Products (Biodegradable netting, mats or blankets)
Biodegradable mulches (straw or fiber), netting or mats
Gravel or rock to stabilize soil
Impervious covers (plastic or woven sheeting)
Sediment control basin or traps
Silt fences
Tracking Control (rumbles strips or rock)
Other ____
None

2. Identify the dominate type of cover on the right bank (Choose one of the following).

   Trees
   Shrubs
   Grasses
   Bare Soil
   Other
   Not applicable, not my property

3. Estimate average width of riparian vegetated cover on the right bank (top of bank to edge of farm or non-cropped areas such as a road). Choose one of the following:

   Not applicable, not my property
   0 ft (bare soil)
   1-5 ft
   6-10 ft
   11-15 ft
   15-20 ft
   21-25 ft
   26-30 ft
   > 30 ft

4. Identify the dominate type of cover on the left bank (Choose one of the following).

   Trees
   Shrubs
   Grasses
   Bare Soil
   Other
   Not applicable, not my property

5. Estimate average width of riparian vegetated cover on the left bank (top of bank to edge of farm or non-cropped areas such as a road). Choose one of the following:

   Not applicable, not my property
   0 ft (bare soil)
   1-5 ft
   6-10 ft
   11-15 ft
   15-20 ft
   21-25 ft
   26-30 ft
   > 30 ft

Exhibit 27

United States
Department of
Agriculture

Forest Service

Pacific Northwest
Research Station

General Technical
Report
PNW-GTR-526
March 2002

Photo Point Monitoring Handbook:

Part A–Field Procedures

Frederick C. Hall

Author
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Photo Point Monitoring Handbook:

Part A–Field Procedures

Frederick C. Hall

Part A contains pages 1–48

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General Technical Report PNW-GTR-526
March 2002

Abstract

Hall, Frederick C. 2001. Photo point monitoring handbook: part A—field procedures. Gen. Tech. Rep. PNW-GTR-526. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 48 p. 2 parts.

This handbook describes quick, effective methods for documenting change in vegetation and soil through repeat photography. It is published in two parts: field procedures in part A and concepts and office analysis in part B. Topics may be effects of logging, change in wildlife habitat, livestock grazing impacts, or stream channel reaction to land management. Land managers, foresters, ranchers, wildlife biologists, and land owners may find this monitoring system useful. Part A discusses three critical elements: (1) maps to find the sampling location and maps of the photo monitoring layout; (2) documentation of the monitoring system to include purpose, camera and film, weather, season, sampling system, and equipment; and (3) precise replication in the repeat photography.

Keywords: Monitoring, photography.

Preface

This handbook is a synopsis of repeat photography principles and photo point sampling from the publication *Ground Based Photographic Monitoring*, PNW-GTR-503, which is based on 45 years of experience in repeat photography by the author. During those years, many nuances were discovered that bear discussion and emphasis so that new users can avoid the pitfalls I ran into. The terms *should*, *must*, *do not*, and *will* are used to help users avoid problems and are not meant as rules.

Contents

Introduction

Anyone interested in quick and effective documentation of change in vegetation or soil through repeat photography will find this handbook useful. Illustrations cover such topics as streamside changes, riparian willow response to beavers, logging, livestock use, and mountain pine beetle (*Dendroctonus ponderosa*) kill of lodgepole pine (*Pinus contorta* var. *latifolia* Englm.). People, such as foresters, ranchers, wildlife biologists, and nature enthusiasts, interested in natural resources can establish photo point monitoring (discussed here) to appraise changes (see part B) in natural resources. No special skill or training is required other than some knowledge of cameras.

There is one essential criteria if repeat photography is used to document change. Distance from camera to photo point **must** remain the same (part B). For this reason, both the camera location and photo point require permanent markers. The system recommended is use of cheap fenceposts or steel stakes, usually ½ inch (1.2 cm) diameter concrete reinforcing bar.

This field procedure handbook is divided into several parts: basic foundations for photo monitoring, with discussions on objectives, selecting an area, techniques for general photography, procedures for specific topic pictures, shrub profile monitoring, and tree cover sampling. Use of forms in part B are illustrated.

Basics

The primary consideration in photo monitoring is an objective. Ask yourself several questions: What is the topic of this photograph? Why do I want to take this picture? What am I trying to show? What appeals to me? What will the picture demonstrate? (Hedgecoe 1994, Johnson 1991).

Photo Monitoring Objectives

Consider the five basic questions for any inquiry: why, where, what, when, and how (Borman 1995, Nader and others 1995).

Why—“Why” to monitor reveals the question or questions needing to be answered. Implementation monitoring asks **if** we did what we said, effectiveness asks if it **did** what we wanted, and validation asks if it **is** meeting the objectives. The “why” question

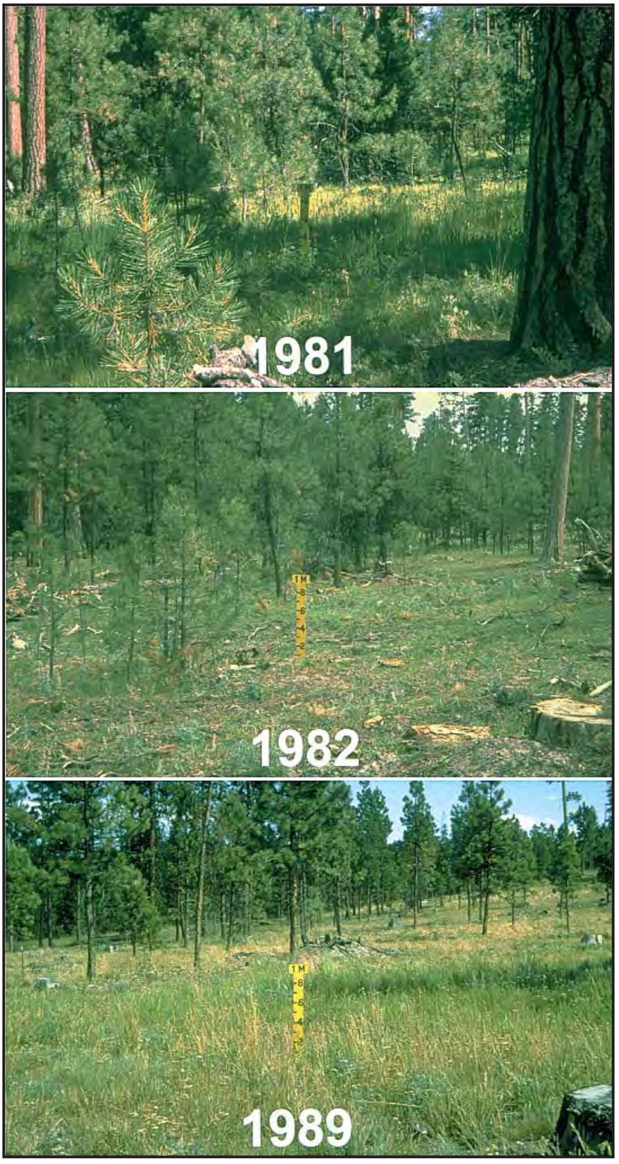
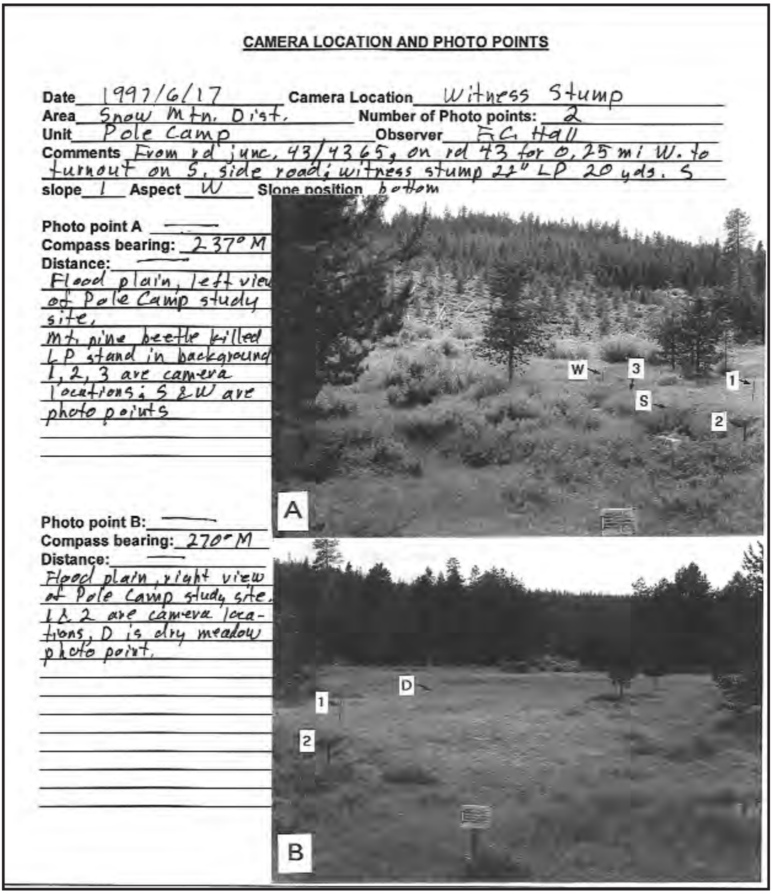


Figure 1—A ponderosa pine stand with pinegrass ground vegetation showing effects of logging: undisturbed in 1981, 1982 after the first selection cut, and in 1989 after the second selection cut and precommercial thinning. These views, with their dramatic differences, emphasize the need for permanent marking of both camera locations and photo points. Exact picture reorientation uses the “1M” of the meter board as the photographic center (also see fig. 18) and for focusing the camera for best depth of field at the meter board.



CAMERA LOCATION AND PHOTO POINTS

Date 1997/6/17 Camera Location Witness Stump
Area Snow Mtn. Dist. Number of Photo points: 2
Unit Pole Camp Observer F.C. Hall
Comments From rd junc. 43/4365, on rd 43 for 0.25 mi W. to turnout on S. side road; witness stump 22" LP 20 yds. S
slope 1 Aspect W Slope position bottom

Photo point A ——
Compass bearing: 237° M
Distance: ——
Flood plain, left view of Pole Camp study site, Mt. pine beetle killed LP stand in background. 1, 2, 3 are camera locations; S & W are photo points

Photo point B: ——
Compass bearing: 270° M
Distance: ——
Flood plain, right view of Pole Camp study site. 1 & 2 are camera locations, D is dry meadow photo point.

Figure 2—Filing system form “Camera Location and Photo Points” showing general photographs of Pole Camp taken from the witness stump: (**A**) the left landscape, and (**B**) the right landscape diagramed in figure 6. Note repeat of fenceposts 1 and 2 in both pictures. Fenceposts identify camera locations 1, 2 and 3 and photo points “D” for the dry meadow, “W” for the wet meadow, and “S” for the streambank. Photo identification cards similar to figure 10, a form from part B, appendix A, are at the bottom of each picture. The purpose of these photographs is twofold: to illustrate the general sampling area and to show location of the photo monitoring layout. Used in conjunction with the map in figure 6, someone other than the original sampling crew could find and rephotograph this site.

sets the stage for all other discussion. Is a proposed treatment to be monitored (fig. 1)? Is animal distribution to be appraised? Are things changing as a result of management decisions (Borman 1995, Nader and others 1995)?

Figure 3—A general photograph taken in 1997 at Pole Camp; the topic is streambank stability. This streambank photo point is taken upstream from camera location 2 (shown in fig. 2 and on the map in fig. 6). Fencepost 1 is camera location 1, fencepost 3 is camera location 3 looking downstream at photo point “S,” ”S” is the photo point for the streambank, and fencepost ”W” is the photo point for the wet meadow.

Where—“Where” to monitor depends on the “why.” How does one select representative tracts, animal activity areas, treatment sites, or particular kinds of treatments? How are number, size, and location of activities, such as fire, logging, revegetation, livestock grazing or flood, selected? Ask yourself, “Where is the best location that will answer my questions (fig. 2; Borman 1995, Nader and others 1995)?” Critical documents are a map to locate the site and a site map to document all camera locations and photo points.

What—“What” to monitor means selecting specific items (topics) on the tract to support the “why” questions: vegetation, soil, streambanks (fig. 3), or animals. Ask yourself, “What are the critical few items that must be documented? What is expected to change? What will the picture demonstrate (Borman 1995, Johnson 1991, Nader and others 1995)?” The “what” dictates the sampling layout.

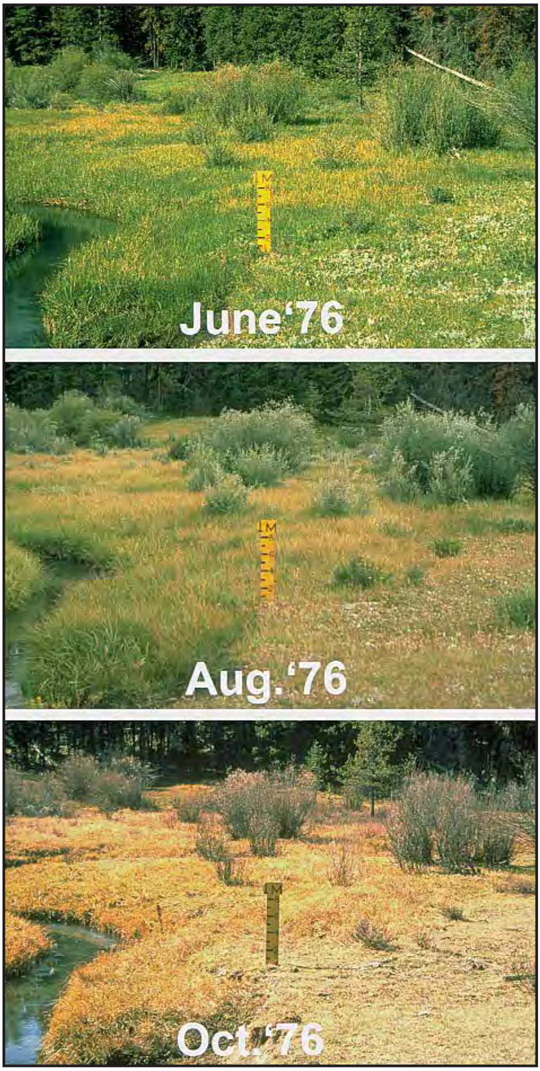


Figure 4—Pole Camp "W" (wet meadow) photo point showing three dates of the same year. June 15 is before scheduled grazing, August 1 is at change in rotation pastures, and October 1 is after grazing. This pasture was rested from June 15 to August 1. October 1 illustrates the degree of livestock use on Kentucky bluegrass at the meter board, on aquatic sedge behind the board, and on willows.

When—"When" to monitor supports the "why" and "what" questions. Does it encompass a year or years? one or more times a year (fig. 4)? specific dates? specific time(s) of day (Borman 1995, Nader and others 1995)? All are important with both animal and site monitoring. Scheduling when to photograph deals with before and after treatment and how often thereafter. Unplanned disturbances, such as fire or flood, pose special problems. A monitoring protocol may have to be developed on the spot during an event to establish photo points and define a followup schedule.

How—"How" to monitor is determined by "what" as influenced by "why" and "when." It may encompass detailed protocols for photographic procedures, which may be to obtain either qualitative data (estimates) or quantitative data (measured in the field or measured from photographs).

A simple question might deal with effects of livestock grazing on a riparian area: (1) Are streambanks being broken down? (2) Are riparian shrubs able to grow in both height and crown spread? (3) Is there enough herbage remaining after grazing to trap sediments from flooding? (4) Is herbaceous vegetation stable, improving, or deteriorating?

These questions require selection of a sampling location, placement of enough photo points to answer each of the four questions, and establishment of camera locations to adequately photograph each photo point. Try to select camera locations that will photograph more than one photo point. Next, time or times of year to do the photography must be specified, such as just prior to animal use of the area, just after they leave, or fall vegetation conditions. Will a riparian site be monitored for high spring runoff? late season low flows? or during floods? Monitoring of stream flows vs. animal use probably will require different scheduling.

Recommendation—Write down the specific objectives and protocols for each photo monitoring project. Write them so that someone other than the installer can understand the purpose, can follow the protocols, and can become enthusiastic about the project.

Selecting an Area

Selection of a monitoring area requires a great deal of professional expertise liberally mixed with artistic finesse. The **purpose** for photographic monitoring is the most critical factor in considering where to monitor (Borman 1995, Nader and others 1995): Where in the landscape is my topic of concern, and once at the area, what kind of change do I want to document? In some cases, "where" is straight forward; for example, documentation of logging impacts requires an area being logged (fig. 1), and effects of beavers on a stream requires beaver dams. On the other hand, documentation of impacts from livestock grazing requires understanding livestock distribution plus knowing the location of areas sensitive to grazing and the most critical season of use.

Once in an area, the real decisions must be made. Determine specifically what to monitor for change. Figure 2 shows two general views of Pole Camp in northeast Oregon where some examples of photo monitoring are located. The purpose was to document effects on a riparian area from livestock grazing. Pole Camp was selected because it was preferred by livestock. Specific objectives were to evaluate grazing effects on streambanks (fig. 3); willow (*Salix* spp.) shrub utilization (fig. 3); differences in use between Kentucky bluegrass (*Poa pratensis* L.) by the fencepost on the right (1) and aquatic sedge (*Carex aquatilis* Wahlenb.) at the fencepost in the left background (W). The topic in figure 3 is streambank stability.

Figure 1 is a different situation. The purpose for photo sampling was to document effects of a two-stage overstory removal and subsequent precommercial thinning on stand structure and ground vegetation. The sale area determined the site. Stand conditions of open ponderosa pine (*Pinus ponderosa* Dougl. ex Laws.) and clumped reproduction across an opening were chosen for the photo point. The opening was selected to avoid tree crown encroachment between the camera location and photo point and to appraise logging effects on livestock forage. It was photographed before and after each entry to log.

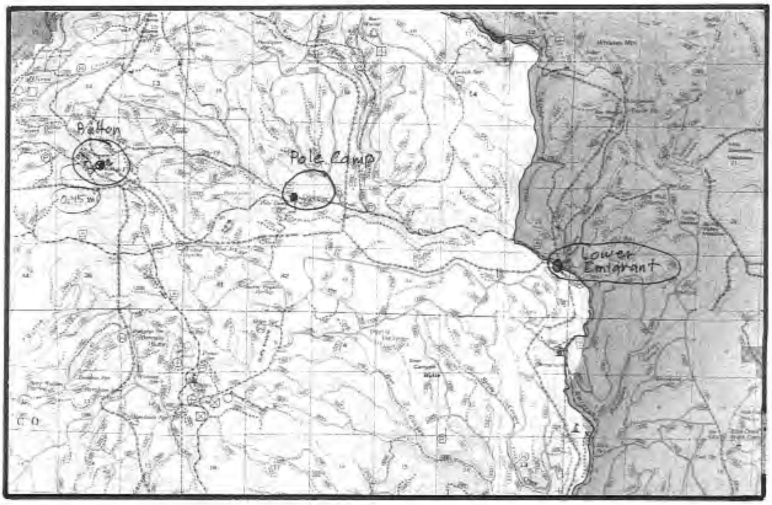


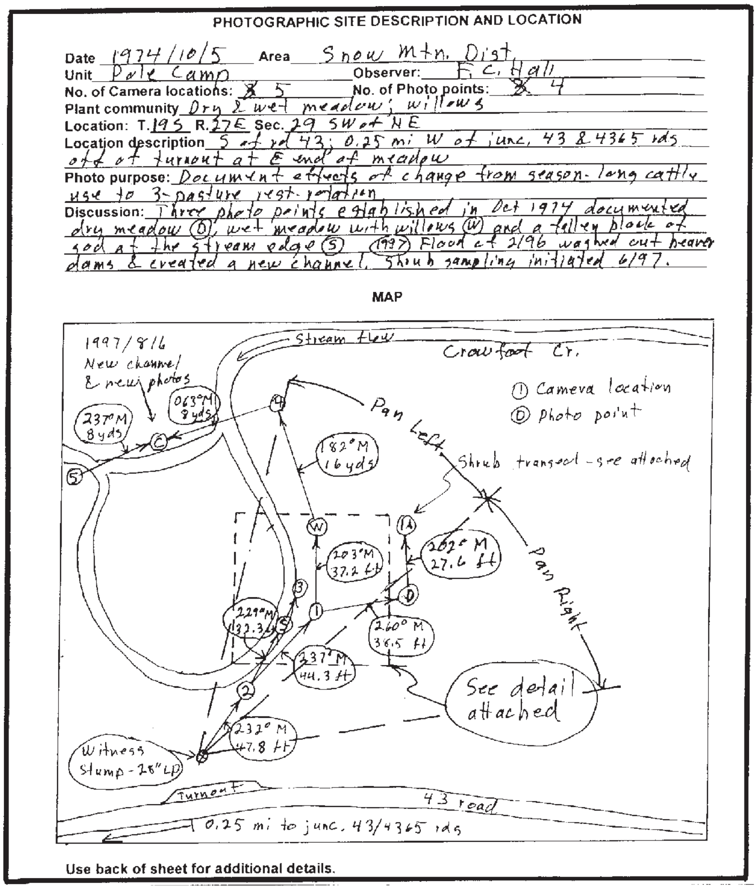
Figure 5—USDA Forest Service ranger district map showing location of the Button Meadow, Pole Camp, and Lower Emigrant riparian study sites. Road numbers, mileage from road junctions, and directions to the witness sites are given on the filing system form “Photographic Site Description and Location” (fig. 6).

After appraising the area, establish the photo monitoring system as discussed below in “General Photography” and “Topic Photography.” The sampling layout must be mapped as described next.

Locating the Monitoring System

Assume that the person installing the monitoring program will **not** be the one to find and rephotograph the area. Provide maps and instructions accordingly. A local map showing roads and the site locates Pole Camp, one of three locations for the Emigrant Creek riparian study (fig. 5).

After laying out the photography system, select a witness site to mark the area. Identify it with a permanent marker, such as an orange aluminum tag, and determine direction and measured distance to camera locations, photo points, or both. Inscribe these on the identification tag. Next map the camera locations and photo points with directions and measured distances on the filing system form “Photographic Site Description and Location” (fig. 6), found in part B, appendix A. Note whether the direction



PHOTOGRAPHIC SITE DESCRIPTION AND LOCATION

Date 1974/10/5 Area Snow Mtn. Dist.
Unit Pole Camp Observer: F. C. Hall
No. of Camera locations: ~~3~~ 5 No. of Photo points: ~~3~~ 4
Plant community Dry & wet meadow; willows
Location: T. 19S R. 27E Sec. 29 SW of NE
Location description S of rd 43; 0.25 mi W of junc. 43 & 4365 rds off of turnout at E end of meadow
Photo purpose: Document effects of change from season-long cattle use to 3-pasture rest-rotation
Discussion: Three photo points established in Oct 1974 documented dry meadow (D), wet meadow with willows (W) and a fallen block of sod at the stream edge (S). (1997) Flood of 2/96 washed out beaver dams & created a new channel. Shrub sampling initiated 6/97.

MAP

Use back of sheet for additional details.

Figure 6—Filing system form "Photographic Site Description and Location" showing the monitoring layout for Pole Camp. In the lower left corner is a reference to the junction of roads 43 and 4365 at 0.25 mile (0.4 km). Immediately opposite the road turnout is a lodgepole pine witness stump 28 inches (71 cm) in diameter. An aluminum tag, orange for visibility, is attached to the stump with directions and distances to camera locations. An additional map, noted by the square labeled "See detail attached," is shown in figure 17. It documents triangulation of the streambank photo point "S." Another note, "Shrub transect - see attached," refers to an installation in 1997, which is shown in figures 22, 23, and 25 dealing with shrub profile photo monitoring.

is taken in magnetic or true degrees by indicating either "M" or "T." A 21-degree deviation in the Pacific Northwest must be accounted for. Measure distances between the witness site, camera locations, and photo points on the ground. Do not attempt conversion to horizontal distance.

Fenceposts or stakes—Monitoring, by definition, means repeated observation; therefore, all camera locations and photo points must be permanently marked. The recommended method is stamped metal fenceposts shown in figures 2 and 3. In 2000, these cost about $2.75 each for a 5-foot (1.5-m) post. Stamped metal has several advantages over strong T-bar posts: they are flimsy and will bend if driven over by a vehicle or run into by an animal; they will bend flat and remain in the ground to mark the spot; they resist theft because they are just as difficult to pull out as a good fencepost but are not worth the trouble; and they are easy to carry and pound. The primary advantage of flimsy fenceposts is their visibility, as seen in figures 2 and 3. If visibility is not desired, steel rebar stakes are a choice but require a metal detector for relocation (White's Electronics, Inc. 1996).

Steel stakes, preferably concrete reenforcing bar (rebar) have been used and may be required for shallow soils, areas that will be disturbed, or locations where fenceposts may be obtrusive. If disturbance or shallow soils prevents the use of fenceposts, stakes should be driven flush with the ground. If left a few inches above the ground, stakes will damage tires, hooves, or feet. They are always difficult to find. When driven flush with the ground, they require a metal detector for relocation (White's Electronics, Inc. 1996), but even then, the stakes must be of some mass for detection with a simple, $250 machine. Angle iron should be 1 inch (2.5 cm) on the angle and at least 12 inches (30 cm) long. Cement reenforcing bar should be at least ⅜ inch (1 cm) in diameter and at least 12 inches (30 cm) long. Shorter lengths may be needed for shallow soils.

Distance from camera to photo point—One overriding consideration in photo monitoring is to use the same distance between the camera location and photo point for all subsequent photography of that sample. Any analysis of change depicted in the photographs can be made **only** when the distance remains the same (part B). Therefore, always **measure** the distance from camera location to photo point and mark with steel fence-posts or stakes.

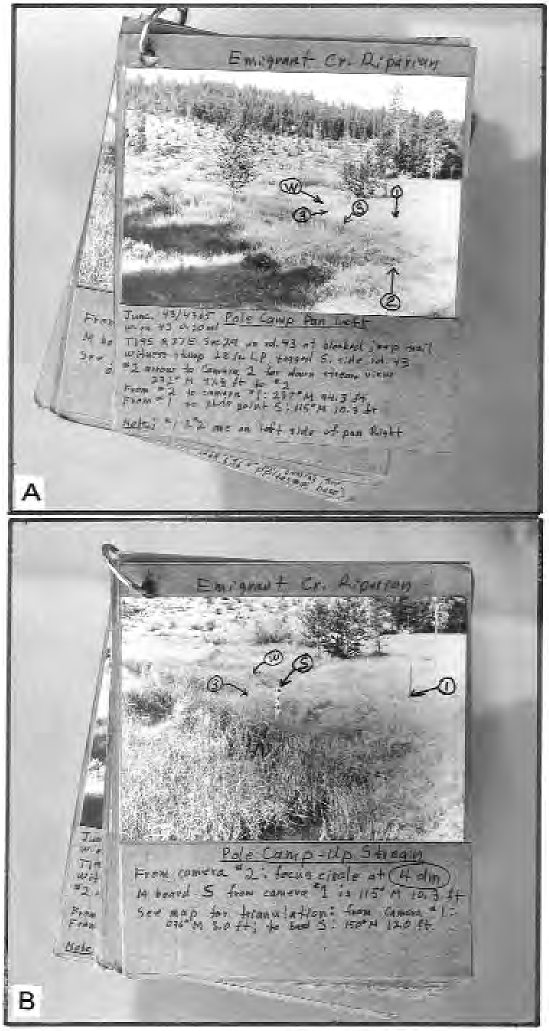


Figure 7—A site locator fieldbook is my system for finding camera locations and photo points. It is a pocket-sized set of photographs and directions mounted on cardboard (file separator thickness). (**A**) The left landscape view of the sampling area at Pole Camp shown in figure 2. (**A**) also locates camera locations 1, 2, and 3. Camera location 1 has two photo points: “D” is Pole Camp dry meadow and “W” is Pole Camp wet meadow (figs. 2 and 6). (**B**) The upstream photo point taken from camera location (2) to “S” (illustrated in fig. 3). A map of this area is shown in figure 6.

A fixed distance for all photo monitoring is not required. It may differ from one photo point to another. Camera format also may change, such as first pictures with a 50mm lens and next pictures with a 35mm lens, but distance must remain the same. It can remain the same in repeat photography only if permanently marked.

Site locator fieldbook—A photo monitoring fieldbook is recommended for carrying the original photos and some intervening photographs into the field (fig. 7). If previous photographs were done by different people, you may discover some disorientation of subsequent views. For that reason, a copy of the original photograph is very important. Rephotograph from the original and not from any misoriented intervening views.

My system for Pole Camp is depicted in figure 7. Figure 7A is a landscape view of the Pole Camp flood plain from the witness site that identifies camera locations and some photo points. It locates the left of two flood-plain scenes, both shown in figure 2 (and mapped in fig. 6). Figure 7B is a view from camera location 2 to photo point "S" on the streambank, the scene in figure 3.

The pocket-size booklet has a picture from each witness site to each camera location and photo point and includes directions from the witness site to camera location and orientation of the photo point.

Once at the area, review the photographs for changes in vegetation. Next, note the number of years since the last photograph, particularly if it was taken more than 3 years previous. The purpose is to evaluate change in the vegetation that might make previous photographs difficult to interpret (fig.1).

Relocating Photo Points

If camera locations and photo points were not marked, they may be approximated by the following triangulation procedure. Align items in the original photograph as shown in figure 8A. Start in the center of the photograph to orient the direction of the picture and draw line 1 on the photo, the photo point direction. Then, for

Text continues on page 15.

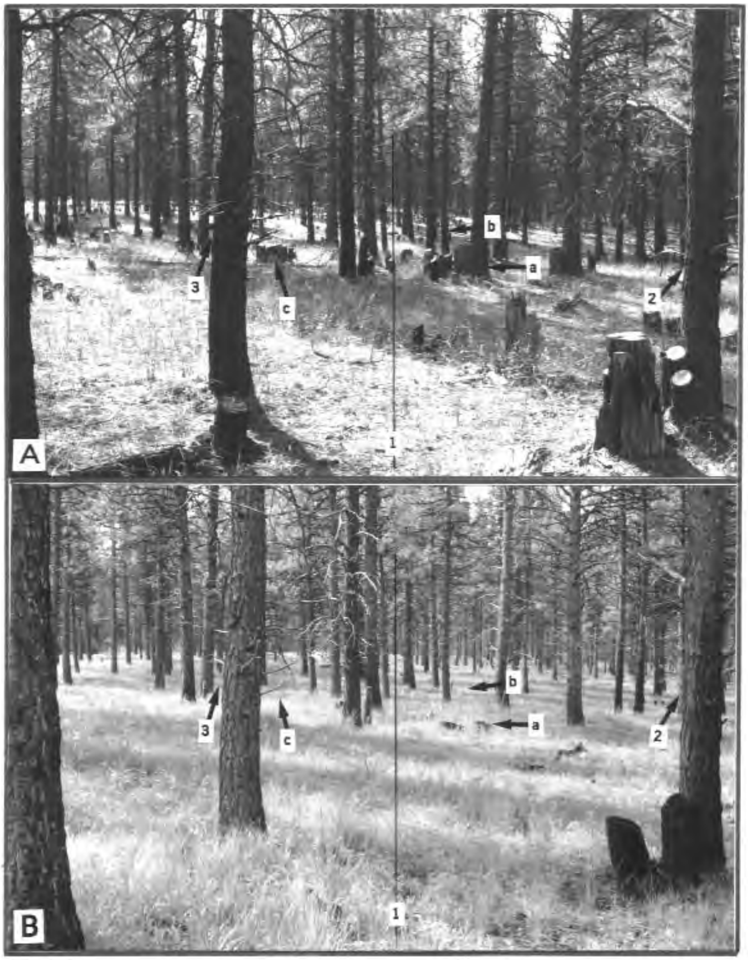


Figure 8—Photograph reorientation uses a black-and-white photo on which a triangulation system is diagramed. A center line (1) is established on the original photograph (**A**) for direction. The center line is identified by position of trees in the background and framing the picture with trees in the foreground. Then positions of items 2 and 3 at the sides of the picture are used to triangulate the camera location. Looking to the right, note the position of trees at arrow 2 while also looking left for tree positions at arrow 3. For (**B**), the photographer moves forward and backward along the center line until items at arrow 2 and arrow 3 are aligned. Try to include some unusual object in the photograph, such as the pair of stumps in the lower right corner. Photograph (**A**) is preunderburn condition and (**B**) is postburn and salvage of killed trees. In (**B**), note the missing trees at arrows "a" and "b," and a burned-out stump at arrow "c."

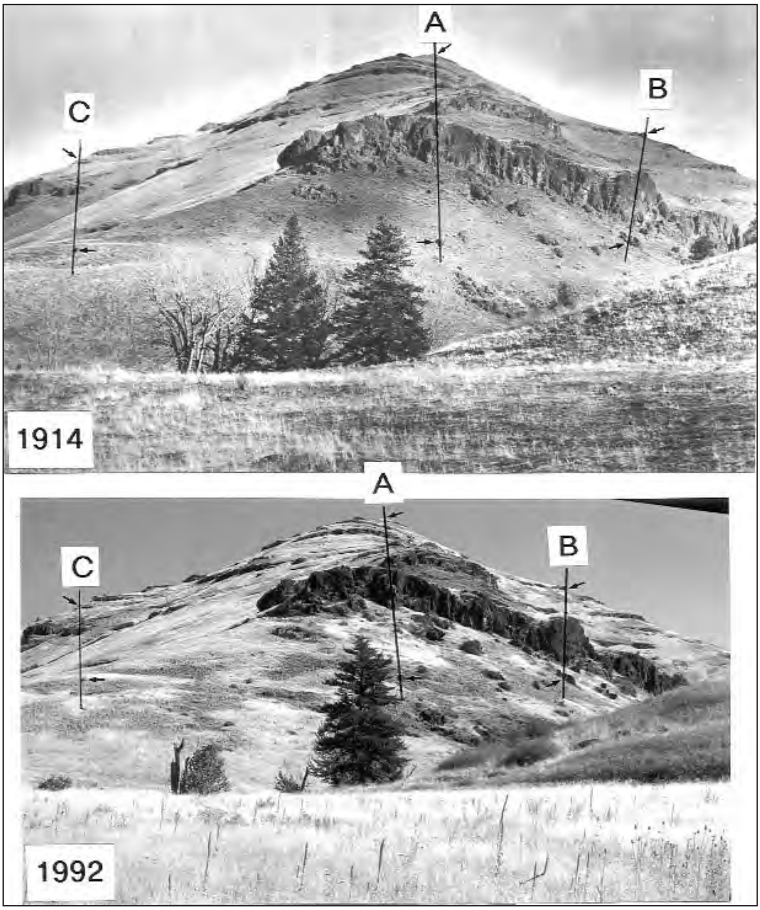


Figure 9—Relocation of a historical photograph taken in 1914 of Branson Creek, Wallowa County, Oregon. Skovlin and Thomas (1995, p. 22-23) took the bottom view in 1992. On a copy of the original (1914) photo, mark orientation lines. “A” identifies the centerline orientation. Then choose objects on the edges of the picture, such as “B” and “C,” to triangulate location of the original camera. Once centered on the original photograph, move forward or backward until the angles of B and C are similar to the original photograph. Slight differences in orientation lines between 1914 and 1992 suggest that in 1992, the camera was a few yards left of the original location. The usefulness of black-and-white photographs is illustrated here by being able to draw triangulation lines directly on a copy of the 1914 picture.

the camera location, find items on the sides of the picture, shown by arrows 2 and 3, to triangulate the location. The items are distances between trees. Move forward or backward along line 1 (fig. 8B) to repeat the distances shown at 2 and 3. This is the camera location and photo point direction. Mark the camera location with a fencepost and add a meter board (photo point) location 25 to 35 feet (8 to 10 m) distant.

Figure 9 applies this triangulation concept to relocation of landscape photographs.

If major vegetation manipulation has occurred as shown in figure 1, relocation may be very difficult.

When to Photograph

When to photograph is usually determined by the activity being monitored. Pole Camp, for example, is part of a study evaluating effects of cattle grazing on a riparian area. Figure 3 illustrates one topic of concern, streambank stability. Photographs have been taken three times per year to correspond with livestock activity: June 15 just before grazing, August 1 as cattle change pastures, and October 1 after animals leave the allotment (fig. 4). This three-season monitoring is repeated every year.

Figure 1 illustrates a very different monitoring schedule. Photographs were planned for the first week in August as an index to appraise vegetation development. They were taken just before logging and in each of the two seasons after cutting to document rapid changes in ground vegetation. Then a 5-year rephotography cycle was established to follow slower changes in both stand structure and ground vegetation. The routine was repeated with the second logging and the precommercial thinning.

If vegetation is a primary topic, consider establishing a fixed date or dates for rephotography. Established dates have several advantages: (1) they set a consistent reference point to evaluate seasonal differences in plant phenological development, (2) they provide a consistent reference for comparing change over several years, and (3) they establish a consistent time interval over which change is documented.

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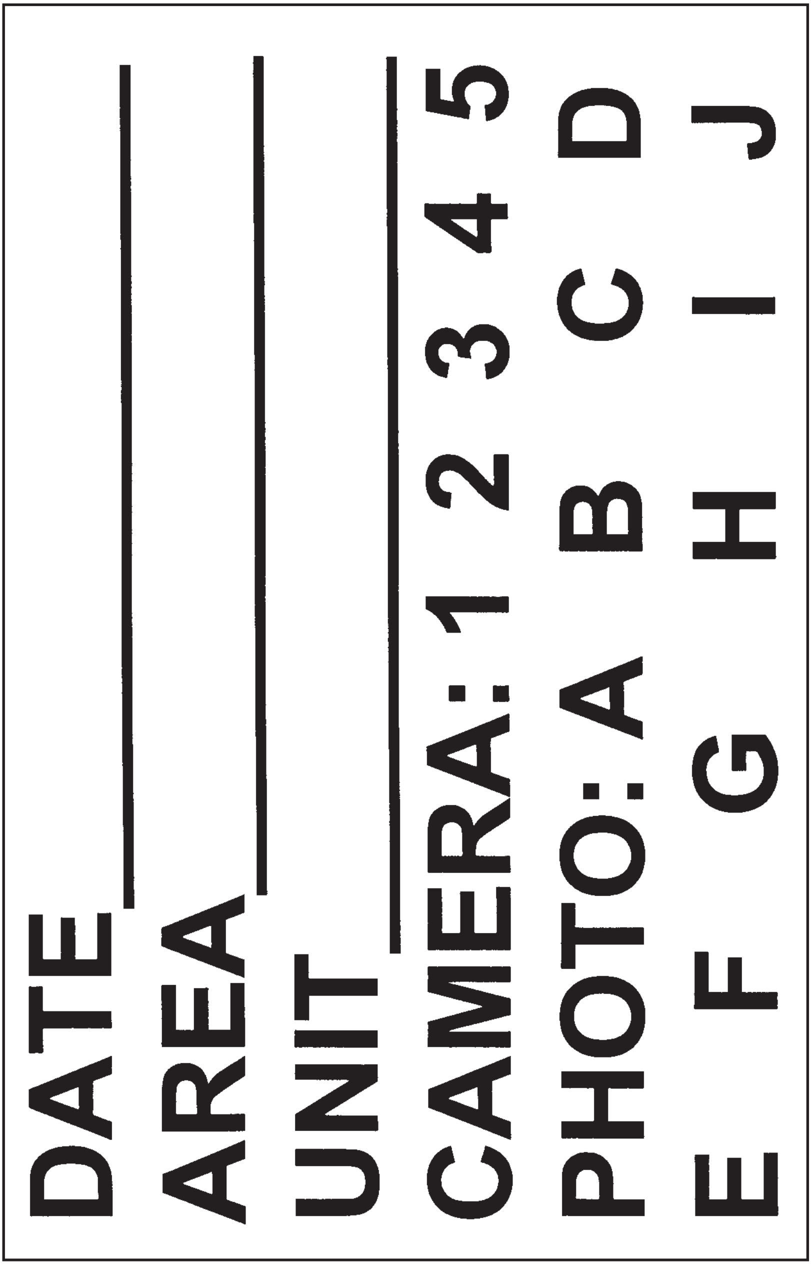


Figure 10—An example of a photograph identification card to be placed in the camera view (fig. 2). This has been reduced to 60 percent of its original size. Part B, appendix A has blank forms that can be reproduced onto dark blue paper. The best paper colors are Hammermill Brite Hue Blue or Georgia Pacific Papers Hots Blue. Light colored paper, common in the office environment, bleaches out under direct sun and should not be used.

PHOTO POINTS AND CLOSE PHOTOS

Date 77/6/6 Camera Plot 226 (669)

Area Snow Mtn. Dist.
Unit Green Butte
Photo point: A
Observer F. C. Hall
Remarks 15 yr retake of ecology plot just prior to partial cut. Good range condition; benchmark for range condition guides, see plot 226 (669) for data

Photo point A:
Left of meter board
Species/cover:
CAGE 60 %
PONE 15 %
CARO 5 %

Comments: Very good range condition; tight sod.

Photo point A:
Right of meter board
Species/cover:
CAGE 50 %
PONE 25 %
CARO 8 %
FRVI 2 %

Comments: Very good condition

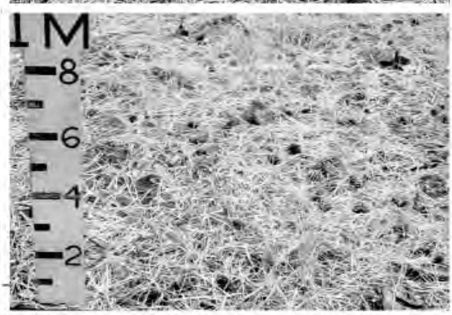


Figure 11—Filing system form “Photo Points and Close Photos” documenting a ponderosa pine/elk sedge community. This area had not been previously logged and had only sporadic sheep use because water was 1.5 miles (2.4 km) distant. The general view is followed by pictures to the left and right of the meter board. The concept is to show both a general view and a pair of closeups to document change. Figure 18 illustrates what happened in this view after logging and 18 years later. Species noted are: CAGE (*Carex geyeri* Boot.), PONE (*Poa nervosa* (Hook.) Vasey), CARO (*Carex rossii* Boot.), and FRVI (*Fragaria virginiana* Duchesne).

Photograph Identification

Each photograph should be identified by site name, photograph number, and date. Figure 10 is an example for use with general or topic photographs (fig. 2). A critical factor is identifying **negatives** for color or black-and-white pictures or digital images. The borders of slides can be written on, but there is no similar place to identify negatives or digital memory card images. Placing a photo identification card in each picture assures a permanent record on the negative or image. This—negative identification—has been one of my biggest problems. Part B, appendix A, contains blank photo identification forms ("Camera-Photo" and "Shrub Photo Sampling"), which can be copied onto medium blue colored paper.

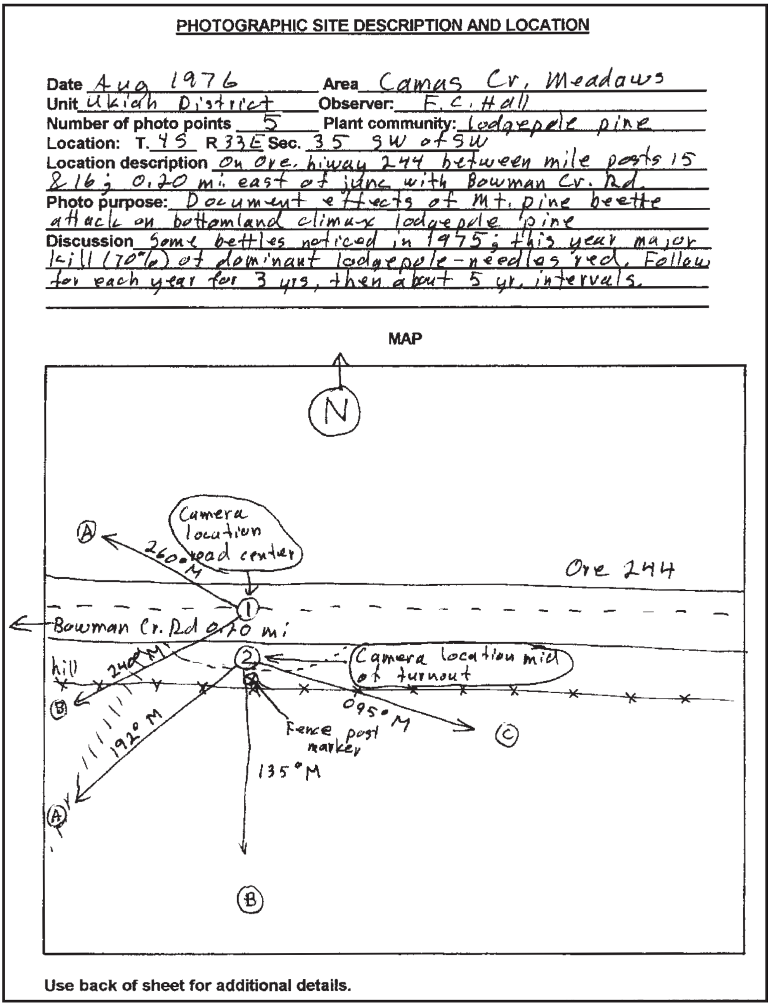
Paper color is the next consideration. Plain white or light colors, common in the office environment, are not suitable because they are too light in color and will bleach out when photographed. The recommended paper color is either Hammermill Brite Hue Blue or Georgia Pacific Papers Hots Blue (part B, app. A). Tests have shown these darker blue hues to be superior to other intense colors such as green and yellow.

Describing the Topic

Describe what is in the photographed scene. Include plant species, ground conditions, disturbances, or any other pertinent item. Part B, appendix A, contains forms having provision for recording these notes. For example, the filing system form "Camera Location and Photo Points" is shown in figure 2 with two views of Pole Camp and brief comments about each photo. And figure 11 is the "Photo Points and Close Photos" form for a general view and two closeup photographs of a ponderosa pine/elk sedge (*Carex geyeri* Boot.) plant community in undisturbed condition. Canopy cover estimates of dominant species are recorded in each closeup photo. Other topic description forms are discussed below in "Shrub Profile Photo Monitoring" and "Tree Cover Sampling." The forms are available in part B, appendix A.

General Photography

General photographs document a scene rather than a specific topic marked by a meter board. They are similar to landscape pictures in that they may not contain a size control board (meter



PHOTOGRAPHIC SITE DESCRIPTION AND LOCATION

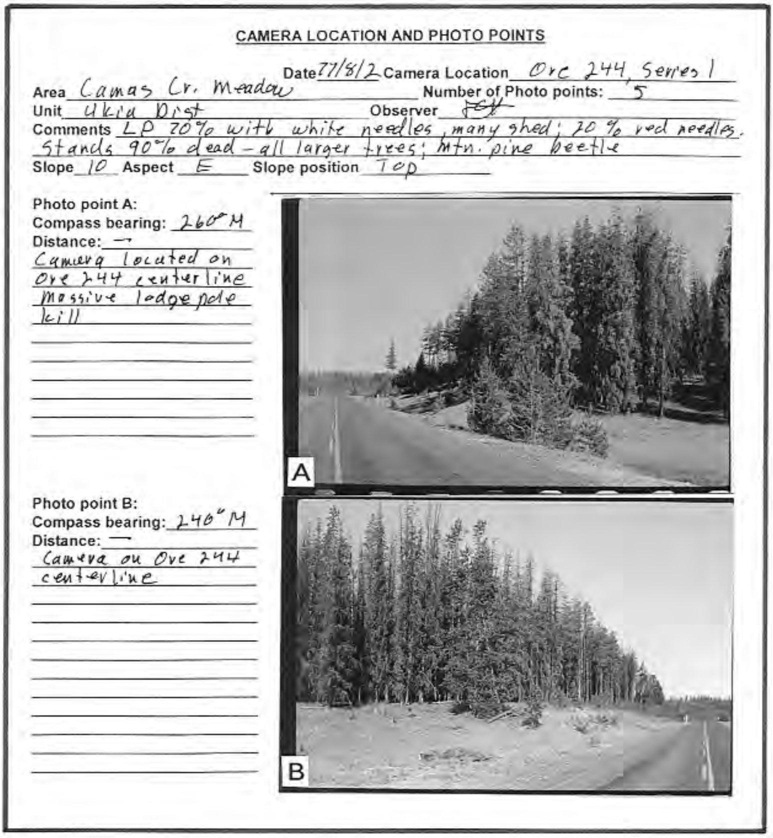
Date Aug 1976 Area Camas Cr. Meadows
Unit Ukiah District Observer: F. C. Hall
Number of photo points 5 Plant community: lodgepole pine
Location: T. 4S R 33E Sec. 35 SW of SW
Location description On Ore. hiway 244 between mile posts 15 & 16; 0.20 mi. east of junc with Bowman Cr. Rd.
Photo purpose: Document effects of Mt. pine beetle attack on bottomland climax lodgepole pine
Discussion Some bettles noticed in 1975; this year major kill (70%) of dominant lodgepole - needles red. Follow for each year for 3 yrs, then about 5 yr. intervals.

MAP

Use back of sheet for additional details.

Figure 12—Filing system form “Photographic Site Description and Location” with a map to locate camera locations and photo points to document the affects of mountain pine beetle on lodgepole pine. Two camera locations are shown. Figures 13 to 15 are from camera location 1 and show photo points 1A and 1B.

board) on which to focus the camera and orient subsequent photographs. A photo usually covers an area of 2 to 20 acres (0.8 to 8 ha) and distances of 50 to 200 yards (40 to 180 m) (figs. 12 to 15).



CAMERA LOCATION AND PHOTO POINTS

Date 77/8/2 Camera Location Ore 244, Series 1

Area Camas Cr. Meadow Number of Photo points: 5

Unit Ukia Dist Observer

Comments LP 70% with white needles, many shed; 20% red needles. Stands 90% dead – all larger trees; Mtn. pine beetle

Slope 10 Aspect E Slope position Top

Photo point A:
Compass bearing: 260° M
Distance: —
Camera located on Ore 244 centerline massive lodgepole kill

A

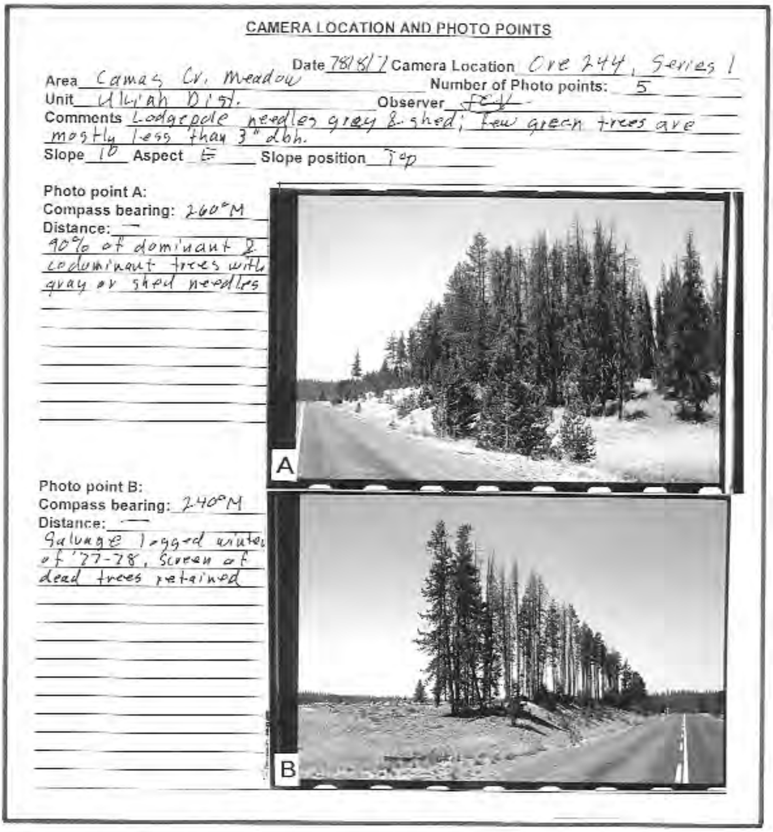
Photo point B:
Compass bearing: 240° M
Distance: —
Camera on Ore 244 centerline

B

Figure 13—Filing system form “Camera Location and Photo Points” documenting stand conditions in 1977, one year after mountain pine beetle attack on lodgepole pine. The needle color on trees killed in the first year changed from green to dark red (not visible here). Compare to figures 14 and 15. Photo orientation used the road center line.

Concept

In many cases, general photographs document a scene in which a meter board cannot be placed to orient and focus the camera. One use of general photographs is shown in figure 2. Filing system form “Camera Location and Photo Points” is used in two pictures of Pole Camp where fenceposts marking camera locations and photo points may be identified. Another use is illustrated in figures 13 to 15, which document effects of mountain pine beetle attacks on lodgepole pine.



CAMERA LOCATION AND PHOTO POINTS

Area Camas Cr. Meadow Date 78/8/7 Camera Location Ore 244, Series 1

Number of Photo points: 5

Unit Ukiah Dist. Observer FCH

Comments Lodgepole needles gray & shed; few green trees are mostly less than 3" dbh.

Slope 10 Aspect E Slope position Top

Photo point A:
Compass bearing: 260°M
Distance: —
90% of dominant & codominant trees with gray or shed needles

A

Photo point B:
Compass bearing: 240°M
Distance: —
Salvage logged winter of '77-78, screen of dead trees retained

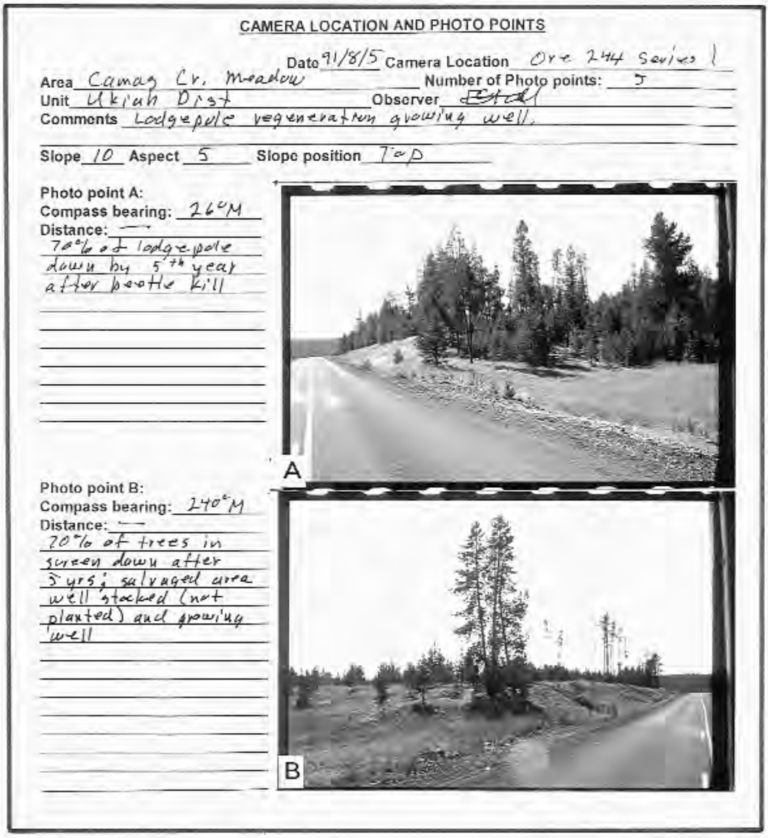
B

Figure 14—Stand conditions in 1978, 2 years after beetle attack in 1976. Photo point "A" has 90 percent kill and massive standing dead fuel. Photo point "B" was salvaged the winter of 1977-78.

Equipment

The following equipment is needed:

1. Camera or cameras for different film, or digital camera.
2. Photograph identification form "Camera-Photo" from part B, appendix A (fig. 10).
3. Clipboard and its support for holding the photo identification sheets (part B, app. B).
4. Compass and 100-foot (30-m) measuring tape.
5. Previous photographs for orientation of the camera.



CAMERA LOCATION AND PHOTO POINTS

Date 91/8/5 Camera Location Ore 244 Series 1
Area Camas Cr. Meadow Number of Photo points: 5
Unit Ukiah Dist Observer [illegible]
Comments Lodgepole regeneration growing well.

Slope 10 Aspect 5 Slope position Top

Photo point A:
Compass bearing: 26°M
Distance: —
70% of lodgepole down by 5th year after beetle kill

A

Photo point B:
Compass bearing: 240°M
Distance: —
70% of trees in screen down after 5 yrs; salvaged area well stocked (not planted) and growing well

B

Figure 15—Stand conditions in 1991, 14 years after beetle attack and 13 growing seasons since figure 13. Photo point "A" shows most dominant trees are down, which creates severe burn conditions at ground level. Photo point "B" illustrates natural regeneration height growth. Orientation of repeat general photography without a meter board requires skill and a set of orientation pictures similar to those in figure 7.

6. Filing system forms "Photographic Site Description and Location" (figs. 6 and 12) and "Camera Location and Photo Points" (figs. 2 and 13-15) from part B, appendix A.
7. Fenceposts and steel stakes sufficient for the number of camera locations desired. Include a pounder.
8. A tripod to use for camera reorientation.

Technique

Select a scene that will meet your monitoring objectives. Describe it, including plant species, ground cover items, disturbance, or whatever the topic of the photograph is by using the filing system form “Camera Location and Photo Points.” Photograph the scene.

Make maps of the location and layout of the scene on the filing system form “Photographic Site Description and Location” (figs. 6 and 12). In figure 6, the two photos from figure 2 are labeled “Pan Left” and “Pan Right.”

Reorientation—Reorientation of subsequent pictures is a major concern due to lack of a meter board. Identification of key items in each view will be needed. In figure 6, for example, the tall tree in the right background of picture (A) is the same tree as in the left background of picture (B). Panoramic views, such as figure 6, always should include about 10 percent overlap between photographs.

Systems used for landscape photo reorientation (discussion at fig. 8) are of major help. On a black-and-white copy of the scene, mark reorientation items as shown in figures 8 and 9. With the camera mounted on a tripod, compare the picture in hand with the scene through the camera. Orient the camera accordingly.

Figure 7 illustrates a site locator fieldbook for rephotographing general views. It has 3- by 5-inch (7.5- by 12.5-cm) photographs mounted on 5- by 5-inch (12.5- by 12.5-cm) cardboard. Instructions are given under each picture for its location and orientation. These fit into a vest pocket for use in the field. Figure 3 is a recent picture of figure 7B.

Example—Figures 13 to 15 illustrate general photography documenting effects of mountain pine beetle on lodgepole pine along highway 244 in the Blue Mountains of eastern Oregon. Figure 12 is filing system form “Photographic Site Description and Location” mapping two camera locations. Camera location 1 has two photo points (figs. 13 to 15) and camera location 2 has three photo points. Monitoring started in 1976 when beetles first attacked the stands.

Figures 13 to 15 show the use of filing system form “Camera Location and Photo Points” to document beetle effects over a 14-year period. Figure 13 depicts second-year effects of beetle attack where trees killed the first year have started to drop their needles. Figure 14 is the third year after attack and shows massive standing fuel (14A) and salvage (14B). Figure 15, 14 years after initial attack and 13 growing seasons after figure 13, illustrates tree fall (15A) and growth of natural regeneration (15B).

Topic Photography

Topic photography narrows the subject from a general view to a specific item of interest. It adds a meter board, or other size control object, to identify the photographic topic (figs. 1, 3, 4, and 11).

Concept

We will assume monitoring objectives have been established as discussed in “Basics.” A meter board, or other size control board, is placed at the selected topic for several reasons: to (1) identify the item being monitored for change; (2) establish a camera orientation reference point for subsequent photography; (3) set up a constant size-reference by which change can be documented, for example by grid analysis; and (4) provide a point on which to focus the camera for optimum depth of field.

Figure 3 illustrates identification of a very specific topic, streambank stability. Figure 1 deals with a general view limited to area around the meter board; the topic is effect of logging and precommercial thinning on stand structure and ground vegetation. Purpose of topic monitoring is the primary factor in selecting a monitoring layout.

The effect of distance from the camera to the meter board to emphasize a topic is shown in figure 16. The topic in 16A is a transect for nested frequency, in 16B it is density of grass and big sagebrush (*Artemisia tridentata* Nutt.), and in 16C it is species density and use (none in this case). Select a camera-to-photo-point distance that best depicts what you want to emphasize. Remember that once the distance is established, it **must** remain fixed.

continued

Exhibit 28

2012 Agricultural Order- Individual Monitoring Costs Estimates

	Laboratory Costs						
	BC	Creek	Pacific EcoRisk	CalTest	Value Used	Minimum conditions**	Maximum conditions***
Field Visit* (including flow or volume, duration of flow, water temperature)					400		
pH*					10		
Conductivity*					10		
Turbidity*					12		
Total Nitrogen*	60	60			60		
Nitrate*	25	30			30		
Total Ammonia*	35	30			35		
Total Cost without pesticides/toxicity:					557	3342	20052
OP Suite- Chlorpyrifos and Diazinon*	175			190	190		
Ceriodaphnia Toxicity*	733		735		750		
Hyallela Toxicity in water	1000		785		1000		
Total Cost of pesticides/toxicity:					1940	7760	46560
Total Cost per year						**11102**	**66612**
Total Cost per half-year						**5551**	**33306**
Notes	*Value from Attachment 1, Appendix F, Staff report for Board Meeting Item 14, March 2011, Central Coast Water Board					**Assumes one tailwater discharge point, one stormwater discharge point, 3 sampling events: 1 without pesticides/toxicity, 2 with pesticides/toxicity	***Assumes 3 tailwater discharge points, three stormwater discharge points, 6 events: 2 without pesticides/toxicity, 4 with pesticides/toxicity

Exhibit 29

Water Boards

CENTRAL COAST WATER BOARD - AGRICULTURAL ORDER
5-Year Compliance Calendar

TIER 1	TIER 2	TIER 3	Agricultural Order R3-2012-0011 Requirement	Reference	Due Date	Check box when completed 2012	2013	2014	2015	2016
✓	✓	✓	1. Enroll - Submit electronic-Notice of Intent (if grower has not already done so).	Order, p24 #55	15-May					
✓	✓	✓	2. Develop/Update Farm Plan.	Order, p21 #44	1-Oct					
✓	✓	✓	3. Install Backflow Prevention devices,if you fertigate or chemigate.	Order, p19 #31	1-Oct					
✓	✓	✓	4. Implement management practices to treat or control discharges and protect water quality.	Order, p4 #10 Order, p15 #12 Order, p20 #36	Ongoing					
✓	✓	✓	5. Minimize bare dirt and prevent erosion to protect water quality.	Order, p20 #37	Ongoing					
✓	✓	✓	6. Protect existing aquatic habitat next to your farm to protect water quality.	Order, p20 #39	Ongoing					
✓	✓	✓	7. Conduct surface receiving water monitoring - Monitor the creeks and estuaries that may receive farm runoff .[1]	Order, p23 #52 MRP, p2 Part 1A	15-Sep					
✓	✓	✓	8. Conduct groundwater monitoring - Monitor primary irrigation well and any drinking water well located on farm.[1]	Order, p23 #51 MRP, p8 Part 2A	Sept-Dec Mar-June			Tier 3 Only	Tier 3 Only	Tier 3 Only
✓	✓	✓	9. Update electronic-Notice of Intent (if necessary)	Order, p8 #27 Order, p24 #55	1-Oct					
✓	✓	✓	10. Report surface receiving water monitoring (Growers can comply individually or by participating in the Cooperative Monitoring Program).[1]	Order, p23 #52 MRP, p2 Part 1B	Various					
✓	✓	✓	11. Report groundwater monitoring.[1]	Order, p23 #51 MRP, p10 Part 2B	1-Oct			Tier 3	Tier 3	Tier 3
	✓	✓	12. Submit Annual Compliance Form.	Order, p27 #67 MRP, p12 Part 3A	1-Oct					
	✓	✓	13. Calculate risk of loading nitrate to groundwater.	Order, p28 #68 MRP, p10 Part 2C	1-Oct					
	✓	✓	14. Conduct photo-monitoring to document the existing condition of adjacent surface water, *if impaired by sediment, turbidity or temperature.*	Order, p28 #69 MRP, p14 Part 4A	1-Oct					
	✓	✓	15. Record and report total nitrogen applied, *if the farm/ranch has a high nitrate loading risk.* [2]	Order, p28 #70 MRP, p11 #5	1-Oct					
		✓	16. Conduct individual discharge monitoring.	Order, p29 #72 MRP, p14 Part 5A	1-Oct					
		✓	17. Report indvidual discharge monitoring.	Order, p29 #73 MRP, p15 Part 5B	15-Mar					
		✓	18. Report elements of certified Irrigation and Nutrient Management Plan, *if farm/ranch has a high nitrate loading risk.* [2]	Order, p29 #77 MRP, p19 Part 6B	1-Oct					
		✓	19. Submit Water Quality Buffer Plan, *if farm is adjacent to surface water impaired by sediment, temperature, or turbidity.* [2]	Order, p30 #80 MRP, p20 Part 7A	1-Oct					

Compliance calendar represents summary requirements for each tier. Growers should review complete Order and Monitoring and Reporting Program R3-2012-0011 for details. Right-hand columns indicate the year in which items are due for specific tier. Growers can check the box when completed. Blacked-out boxes indicate no item is due that year. 1-Growers can comply with specific requirements individually or cooperatively (by particpating in the Cooperative Monitoring Program). 2-Alternative method to comply with specific requirement available.

AGRICULTURAL REGULATORY PROGRAM
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Updated August 22, 2012

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S:\Agricultural Regulatory Program\Program Management\Resources4growers_Order2012\Compliance Calendar and Contacts\AgContacts.docx

Exhibit 30

2011 MONTEREY COUNTY Crop Report

Table of Contents

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Chief Deputy Agricultural Commissioner
Richard Ordonez
Karen Stahlman

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Brad Oliver

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Monterey County Agricultural Commissioner

ERIC LAURITZEN
AGRICULTURAL COMMISSIONER

Karen Ross, Secretary

California Department of Food & Agriculture and
The Honorable Board of Supervisors of Monterey County

Dave Potter	5th District, Chair
Fernando Armenta	1st District
Louis Calcagno	2nd District
Simón Salinas	3rd District
Jane Parker	4th District

It is a pleasure to present the 2011 Monterey County Crop Report that is prepared pursuant to the provisions of Section 2279 of the California Food & Agriculture Code. This report reflects a production value of $3.85 billion for Monterey County, a slight decline from 2010 ($153 million, or 3.8%).

Crop values vary from year to year based on production, market and weather conditions. Some noteworthy changes in 2011 include: head lettuce value was down 11% while leaf lettuce was up 7%, continuing the market trend of recent years; strawberry value decreased by 5% and wine grape value was down 18%; and spinach, spring mix and salad products all showed declines based on recent refinements of the data for these crops.

As a complement to the annual crop report, our office recently released *Economic Contributions of Monterey County Agriculture*, a study that quantifies how each dollar generated through agricultural production moves through our local economy. Starting with the production values reported in our annual crop report, that study looked beyond the direct benefits of farm production to include the ripple effects from ag-related business throughout the local economy. The study showed that agriculture contributed $8.2 billion and more than 73,000 jobs to the Monterey County economy in 2010.

It is always important to note that the figures provided here are gross values and do not represent or reflect net profit or loss experienced by individual growers, or by the industry as a whole. Growers do not have control over most input costs, such as fuel, fertilizers and packaging, nor can they significantly affect market prices. The fact that the gross value of agriculture is holding steady reflects positively on the diversity and importance of our agriculture industry.

This report is our yearly opportunity to recognize the growers, shippers, ranchers, and other businesses ancillary to and supportive of agriculture, which is the largest driver of Monterey County's economy. As such, we would like to extend our thanks to the industry for their continued effort to provide vital information that enables the compilation of the Monterey County Crop Report. While we continually strive to improve upon this information, without their assistance, this report would not be possible.

Special recognition for the production of this report goes to Richard Ordonez, Helena Roberts, Shayla Neufeld, Melanie Beretti, and all of the staff who assisted in compiling this information and improving the quality of the report.

Respectfully submitted,

Eric Lauritzen
Agricultural Commissioner

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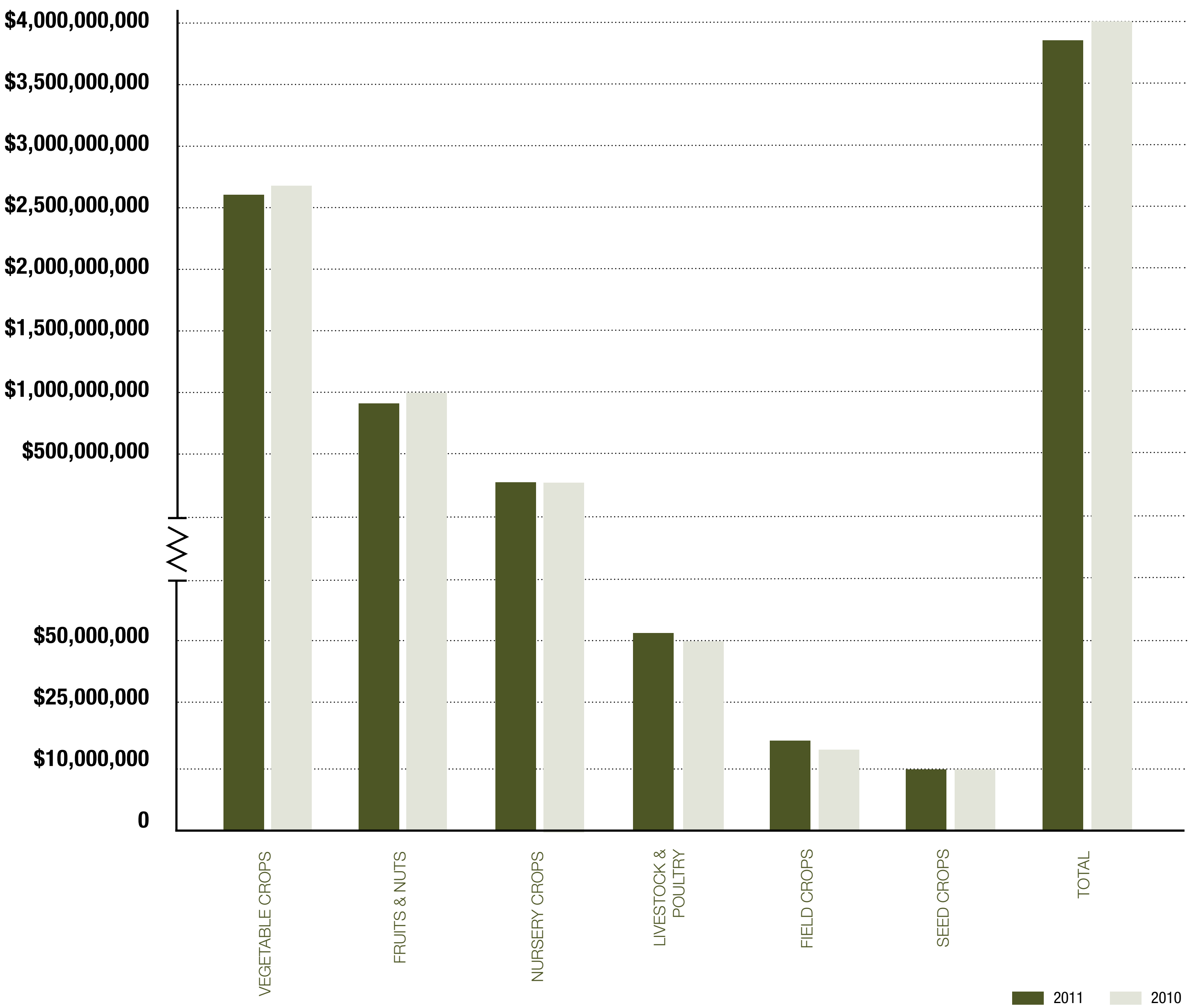
Monterey County's Ten Million Dollar Crops

CROPS	2011 CROP VALUE	2011 CROP RANKING	2010 CROP RANKING
Leaf Lettuce	$777,418,000	1	2
Strawberry	$713,854,000	2	1
Head Lettuce	$454,238,000	3	3
Broccoli	$297,299,000	4	4
Nursery	$260,703,000	5	5
Celery	$182,308,000	6	6
Grapes	$140,976,000	7	7
Misc. Vegetables	$125,512,000	8	9
Cauliflower	$104,970,000	9	11
Spring Mix	$100,776,000	10	8
Spinach	$88,926,000	11	10
Salad Products	$81,599,000	12	12
Mushrooms	$78,966,000	13	13
Artichokes	$49,331,000	14	14
Raspberries	$45,525,000	15	15
Beef Cattle	$44,500,000	16	16
Cabbage	$35,711,000	17	17
Peas	$29,801,000	18	18
Onions, Green	$26,327,000	19	19
Rappini	$23,423,000	20	20
Carrots	$22,030,000	21	21
Radicchio	$19,300,000	22	22
Kale	$17,932,000	23	24
Asparagus	$13,632,000	24	25
Rangeland	$13,065,000	25	26
Citrus	$11,220,000	26	23

Gross Production Value

CATEGORIES	2011 TOTAL VALUE	2010 TOTAL VALUE
Vegetable Crops	$2,596,683,000	$2,677,072,000
Fruit & Nuts	$914,685,000	$987,693,000
Nursery Crops	$260,703,000	$266,121,000
Livestock & Poultry	$54,468,000	$49,893,000
Field Crops	$16,824,000	$15,230,000
Seed Crops	$9,404,000	$9,984,000
Apiary	$228,000	$242,000
TOTAL	**$3,852,995,000**	**$4,006,235,000**



Monterey County's Trends of Major Crops

CROP		1991	2001	2011
Artichokes	Acre	7,545	5,943	4,992
	Value	$29,136,000	$38,473,000	$49,331,000
	CPI Adjusted*	$48,159,000	$48,886,000	$49,331,000
Broccoli	Acre	50,160	54,899	52,694
	Value	$139,343,000	$258,962,000	$297,299,000
	CPI Adjusted	$230,319,000	$329,050,000	$297,299,000
Cauliflower	Acre	23,790	17,390	17,399
	Value	$89,661,000	$102,567,000	$104,970,000
	CPI Adjusted	$148,200,000	$130,327,000	$104,970,000
Celery	Acre	6,929	10,030	11,902
	Value	$40,103,000	$97,988,000	$182,308,000
	CPI Adjusted	$66,286,000	$124,508,000	$182,308,000
Grapes	Acre	33,412	38,098	43,034
	Value	$73,800,000	$207,945,000	$140,976,000
	CPI Adjusted	$121,983,000	$264,225,000	$140,976,000
Head Lettuce	Acre	63,000	57,594	34,800
	Value	$293,295,000	$360,562,000	$454,238,000
	CPI Adjusted	$484,785,000	$458,147,000	$454,238,000
Leaf Lettuce	Acre	26,201	53,745	97,979
	Value	$99,743,000	$298,352,000	$777,418,000
	CPI Adjusted	$164,864,000	$379,100,000	$777,418,000
Mushrooms	Pounds	38,466,000	48,146,000	41,128,000
	Value	$36,927,000	$65,479,000	$78,966,000
	CPI Adjusted	$61,036,000	$83,201,000	$78,966,000
Nursery Products	Acre	1,773	2,088	1,831
	Value	$125,254,000	$178,564,000	$260,703,000
	CPI Adjusted	$207,031,000	$226,892,000	$260,703,000
Spinach	Acre	7,410	13,204	13,900
	Value	$16,555,000	$77,009,000	$88,926,000
	CPI Adjusted	$27,364,000	$97,851,000	$88,926,000
Strawberries	Acre	6,320	6,941	10,992
	Value	$158,149,000	$276,912,000	$713,854,000
	CPI Adjusted	$261,403,000	$351,858,000	$713,854,000
TOTAL OF MAJOR CROPS ABOVE	**Acre**	**226,540**	**259,932**	**289,523**
	Value	**$1,101,966,000**	**$1,962,814,000**	**$3,148,989,000**
	CPI Adjusted	**$1,821,430,000**	**$2,494,045,000**	**$3,148,989,000**

*Consumer Price Index Conversion Factors from http://oregonstate.edu/cla/polisci/sites/default/files/faculty-research/sahr/inflation-conversion/pdf/cv2011.pdf

Vegetable Crops

CROP[1]	YEAR	ACREAGE	PRODUCTION PER ACRE	TOTAL	UNIT	VALUE PER UNIT	TOTAL[2]
Anise	2011	610	19.53	11,900	ton	$787.80	$9,375,000
	2010	602	20.00	12,000	ton	$664.73	$7,977,000
Artichokes	2011	4,992	7.19	35,900	ton	$1,374.13	$49,331,000
	2010	4,959	7.03	34,900	ton	$1,370.44	$47,828,000
Asparagus	2011	1,850	4.18	7,740	ton	$1,761.18	$13,632,000
	2010	2,297	4.20	9,650	ton	$1,600.87	$15,448,000
Bok Choy	2011	491	22.09	10,900	ton	$257.46	$2,806,000
	2010	393	23.81	9,360	ton	$223.73	$2,094,000
Broccoli, Bulk[3]	2011	N/A	N/A	121,000	ton	$534.98	$64,733,000
	2010	N/A	N/A	122,000	ton	$549.08	$66,988,000
Fresh	2011	50,506	7.31	369,000	ton	$630.26	$232,566,000
	2010	49,926	7.21	360,000	ton	$639.27	$230,137,000
Broccoli, Total	2011	52,694	N/A	N/A	N/A	N/A	$297,299,000
	2010	60,926	N/A	N/A	N/A	N/A	$297,125,000
Cabbage, Bulk	2011	N/A	N/A	38,200	ton	$307.47	$11,745,000
	2010	N/A	N/A	37,400	ton	$308.72	$11,546,000
Fresh	2011	3,420	20.48	70,100	ton	$341.88	$23,966,000
	2010	3,251	19.89	64,700	ton	$342.49	$22,159,000
Cabbage, Total	2011	4,925	N/A	N/A	N/A	N/A	$35,711,000
	2010	5,131	N/A	N/A	N/A	N/A	$33,705,000

SPOTLIGHT ON

Vacuum/Hydro-Vacuum Packing

- Vacuum cooling technology for fresh produce was developed with agricultural industry financing, in a location off of Highway 183 between Salinas and Castroville. The first commercial use of vacuum cooling was in Salinas in 1948 for iceberg lettuce.
- Vacuum cooling technologies, also known as precooling product prior to cold storage, are used throughout the world for fresh fruits and vegetables, maintaining product quality by completing an effective "cold chain." Vacuum cooling entails placing product in a cooling chamber typically on pallets, and then removing the air from the chamber using a vacuum pump. As the product reaches its flashpoint a sudden surface water vaporization results, producing a localized cooling effect due to the energy required to make the transition from liquid to vapor H_2O.
- Hydrovacuum cooling, where water is sprayed on the product just before the flashpoint of the vacuum cycle, is used to prevent low moisture content product such a leaf lettuce and celery from drying out.
- Vacuum cooling technology is one of the most energy efficient cooling methods available and cools 2-3 times faster than forced air cooling.

[1] Organic figures included in totals
[2] Totals may not calculate due to rounding
[3] "Bulk" may include one or more of the following:
"Food Service" commodities are destined to be sold to restaurants and food service companies for the preparation of meals eaten away from home, and are sold in larger packages; "Processing" commodities are destined to be processed in a way that substantially alters the raw nature of the product such as freezing, drying, or cooking, and does not necessarily include processes such as washing, slicing, or chopping; and "Value Added" commodities are destined to be sold to consumers to prepare meals at home, and are sold in smaller packages with consumer labeling. Figures do not include additional cost of packaging or washing, slicing, chopping, mixing, etc.

Vegetable Crops (cont'd)

CROP	YEAR	ACREAGE	PRODUCTION PER ACRE	TOTAL	UNIT	VALUE PER UNIT	TOTAL
Carrots, Bulk	2011	N/A	N/A	31,200	ton	$346.42	$10,808,000
	2010	N/A	N/A	28,700	ton	$336.54	$9,659,000
Fresh	2011	1,456	21.22	30,900	ton	$363.17	$11,222,000
	2010	1,431	21.07	30,200	ton	$354.92	$10,719,000
Carrots, Total	2011	3,023	N/A	N/A	N/A	N/A	$22,030,000
	2010	1,863	N/A	N/A	N/A	N/A	$20,378,000
Cauliflower, Bulk	2011	N/A	N/A	22,900	ton	$576.65	$13,205,000
	2010	N/A	N/A	22,100	ton	$569.75	$12,591,000
Fresh	2011	16,260	8.75	142,000	ton	$646.23	$91,765,000
	2010	16,958	8.89	151,000	ton	$648.76	$97,963,000
Cauliflower, Total	2011	17,399	N/A	N/A	N/A	N/A	$104,970,000
	2010	19,444	N/A	N/A	N/A	N/A	$110,554,000
Celery, Bulk	2011	N/A	N/A	37,300	ton	$259.12	$9,665,000
	2010	N/A	N/A	38,100	ton	$263.52	$10,040,000
Fresh	2011	11,816	38.18	451,000	ton	$382.80	$172,643,000
	2010	11,307	38.17	432,000	ton	$383.23	$165,555,000
Celery, Total	2011	11,902	N/A	N/A	N/A	N/A	$182,308,000
	2010	12,305	N/A	N/A	N/A	N/A	$175,595,000
Chard	2011	691	9.11	6,300	ton	$945.27	$5,955,000
	2010	742	9.26	6,870	ton	$906.57	$6,228,000
Cilantro	2011	1,309	4.06	5,310	ton	$806.53	$4,283,000
	2010	634	8.88	5,630	ton	$703.18	$3,959,000
Herbs[4]	2011	105	7.38	775	ton	$2,600.93	$2,016,000
	2010	107	7.27	780	ton	$2,480.43	$1,935,000
Kale	2011	1,944	12.24	23,800	ton	$753.45	$17,932,000
	2010	1,938	12.10	23,400	ton	$745.50	$17,445,000
Leeks	2011	278	12.03	3,340	ton	$1,180.94	$3,944,000
	2010	214	12.46	2,670	ton	$1,130.19	$3,018,000
Lettuce, Total[5]	2011	133,000	N/A	N/A	N/A	N/A	$1,231,656,000
	2010	140,000	N/A	N/A	N/A	N/A	$1,236,523,000
Misc. Vegetables, Bulk	2011	N/A	N/A	157,000	ton	$548.83	$86,166,000
	2010	N/A	N/A	160,000	ton	$572.17	$91,547,000
Fresh[6]	2011	3,802	8.84	33,600	ton	$1,171.02	$39,346,000
	2010	4,130	7.79	32,200	ton	$1,118.68	$36,021,000
Misc. Vegetables Total	2011	21,562	N/A	N/A	N/A	N/A	$125,512,000
	2010	24,669	N/A	N/A	N/A	N/A	$127,568,000

[4] Includes: Oregano, Parsley, Rosemary, Sage, and Thyme
[5] See Lettuce Production for detail information, Page 10
[6] Includes: Arugula, Beets, Broccolini, Brussel Sprouts, Cactus Pears, Cardone, Chicory, Corn, Cucumbers, Fava Beans, Frisee, Garlic, Mache, Potato, and Pumpkins

Vegetable Crops (cont'd)

CROP	YEAR	ACREAGE	PRODUCTION PER ACRE	TOTAL	UNIT	VALUE PER UNIT	TOTAL
Mushrooms	2011	130	N/A	41,128,000	lbs	$1.92	$78,966,000
	2010	157	N/A	37,204,000	lbs	$1.86	$69,199,000
Napa	2011	580	28.17	16,300	ton	$308.45	$5,028,000
	2010	488	28.12	13,700	ton	$326.91	$4,479,000
Onions, Dry	2011	2,137	23.34	49,900	ton	$178.42	$8,903,000
	2010	2,187	23.15	50,600	ton	$181.34	$9,176,000
Onions, Green	2011	1,350	14.36	19,400	ton	$1,357.06	$26,327,000
	2010	1,376	15.04	20,700	ton	$1,291.11	$26,726,000
Parsley	2011	525	16.58	8,700	ton	$805.33	$7,006,000
	2010	497	16.71	8,300	ton	$746.60	$6,197,000
Peas[7]	2011	1,783	N/A	N/A	N/A	N/A	$29,801,000
	2010	1,789	N/A	N/A	N/A	N/A	$30,797,000
Peppers[8]	2011	1,359	17.75	24,100	ton	$317.85	$7,660,000
	2010	1,327	17.44	23,100	ton	$335.52	$7,751,000
Radicchio	2011	2,403	4.67	11,200	ton	$1,723.25	$19,300,000
	2010	2,473	4.41	10,900	ton	$1,791.80	$19,531,000
Radish	2011	145	14.64	2,130	ton	$528.23	$1,125,000
	2010	149	14.13	2,110	ton	$500.43	$1,056,000
Rappini	2011	4,504	3.00	13,500	ton	$1,735.00	$23,423,000
	2010	4,635	3.20	14,800	ton	$1,737.00	$25,708,000
Salad Products	2011	N/A	N/A	196,000	ton	$416.32	$81,599,000
	2010	N/A	N/A	210,000	ton	$420.26	$88,255,000
Spinach, Bulk	2011	N/A	N/A	86,700	ton	$819.72	$71,070,000
	2010	N/A	N/A	52,600	ton	$814.84	$42,861,000
Fresh	2011	2,162	10.43	19,500	ton	$915.67	$17,856,000
	2010	8,934	10.32	92,200	ton	$918.21	$84,659,000
Spinach Total	2011	13,900	N/A	N/A	N/A	N/A	$88,926,000
	2010	9,329	N/A	N/A	N/A	N/A	$127,520,000
Spring Mix	2011	10,746	9.12	74,100	ton	$1,360.00	$100,776,000
	2010	11,078	9.04	100,000	ton	$1,439.75	$143,975,000
Squash	2011	302	10.63	3,210	ton	$558.24	$1,792,000
	2010	300	10.24	3,070	ton	$582.73	$1,789,000
Tomatoes	2011	679	18.48	12,500	ton	$583.27	$7,291,000
	2010	682	19.38	13,200	ton	$570.69	$7,533,000

VEGETABLE CROPS TOTAL	**2011**	**297,318**	**$2,596,683,000**
	2010	312,691	$2,677,072,000

[7] Includes: Bulk
[8] Includes: Chili and Bell Peppers

Lettuce Production - Detail

CROP	YEAR	ACREAGE	PRODUCTION PER ACRE	TOTAL	UNIT	VALUE PER UNIT	TOTAL
HEAD LETTUCE							
Spring	2011	11,261	----	----	----	----	----
	2010	16,378					
Summer	2011	10,934	----	----	----	----	----
	2010	14,170					
Fall	2011	12,605	----	----	----	----	----
	2010	14,026					
Naked Pack	2011	N/A	N/A	5,572,000	ctn	$9.51	$52,990,000
	2010	N/A	N/A	6,433,000	ctn	$11.83	$76,102,000
Wrapped Pack	2011	N/A	N/A	23,634,000	ctn	$10.58	$250,048,000
	2010	N/A	N/A	22,723,000	ctn	$12.88	$292,672,000
Head Lettuce, Bulk	2011	N/A	N/A	378,000	ton	$400.00	$151,200,000
	2010	N/A	N/A	367,000	ton	$390.00	$143,130,000
Head Lettuce, Total	2011	34,800	1,356	47,206,000	ctn	$9.62	$454,238,000
	2010	44,574	983	43,836,000	ctn	$11.68	$511,904,000
LEAF LETTUCE							
Butter Leaf Lettuce	2011	1,500	1,217	1,825,000	ctn	$8.81	$16,078,000
	2010	1,489	1,220	1,816,000	ctn	$9.22	$16,744,000
Endive	2011	406	1,063	432,000	ctn	$8.13	$3,512,000
	2010	408	1,051	429,000	ctn	$8.88	$3,810,000
Escarole	2011	370	1,049	388,000	ctn	$8.96	$3,476,000
	2010	339	1,040	353,000	ctn	$8.88	$3,135,000
Green Leaf Lettuce	2011	7,579	1,040	7,883,000	ctn	$9.21	$72,602,000
	2010	8,294	1,033	8,568,000	ctn	$9.36	$80,196,000
Red Leaf Lettuce	2011	2,210	1,044	2,307,000	ctn	$8.58	$19,794,000
	2010	2,313	1,036	2,396,000	ctn	$8.62	$20,654,000
Romaine Lettuce	2011	37,442	1,037	38,828,000	ctn	$10.15	$394,104,000
	2010	36,294	1,054	38,254,000	ctn	$9.45	$361,500,000
Leaf Lettuce, Bulk	2011	N/A	N/A	606,000	ton	$442.00	$267,852,000
	2010	N/A	N/A	604,000	ton	$395.00	$238,580,000
Leaf Lettuce, Total	2011	97,979	N/A	87,310,000	ctn	$8.90	$777,418,000
	2010	95,436	N/A	87,345,000	ctn	$8.30	$724,619,000
LETTUCE CROPS TOTAL	**2011**	**133,000**		**134,516,000**	**ctn**		**$1,231,656,000**
	2010	140,000		131,181,000	ctn		$1,236,523,000

CROP	YEAR	ACREAGE	PRODUCTION PER ACRE	TOTAL	UNIT	VALUE PER UNIT	TOTAL
Avocados	2011	226	2.07	468	ton	$2,404.30	$1,125,000
	2010	227	3.50	795	ton	$1,540.77	$1,225,000
Citrus	2011	1,239	20.54	25,500	ton	$440.00	$11,220,000
	2010	1,248	30.00	37,400	ton	$486.89	$18,210,000
Grapes[9]	2011	43,034	2.89	124,000	ton	$1,136.90	$140,976,000
	2010	43,321	4.09	177,000	ton	$976.93	$172,916,000
Raspberries	2011	740	15.00	11,100	ton	$4,101.33	$45,525,000
	2010	688	14.99	10,300	ton	$4,122.67	$42,464,000
Strawberries	2011	10,992	34.40	378,000	ton	$1,826.67	$690,481,000
	2010	10,664	37.60	401,000	ton	$1,845.00	$739,845,000
Processing	2011	N/A	N/A	40,500	ton	$577.11	$23,373,000
	2010	N/A	N/A	23,600	ton	$477.52	$11,269,000
Strawberries Total	2011	10,992	N/A	419,000	ton	N/A	$713,854,000
	2010	10,664	N/A	425,000	ton	N/A	$751,114,000
Misc. Fruit[10]	2011	205	6.99	1,430	ton	$1,387.87	$1,985,000
	2010	620	2.53	1,570	ton	$1,123.88	$1,764,000

FRUIT & NUT CROPS TOTAL	**2011**	**56,436**	**$914,685,000**
	2010	56,768	$987,693,000

SPOTLIGHT ON
CSUMB/Community Education

The agricultural community has been a strong supporter of California State University, Monterey Bay since its founding in 1994.

- The Tanimura & Antle Family Memorial Library was built in part thanks to a lead gift of $4 million, the largest gift to date from the agricultural industry. From the moment it opened in 2008, the library has been the center of student and campus life at CSU Monterey Bay, drawing more than 600,000 visitors over the last year.
- The agriculture community provides support for student scholarships. Sponsorships for CSUMB's annual Have a Heart auction from the agricultural community totaled approximately $14,500 this year.
- Businesses involved in agriculture support CSUMB's higher education goals through internships for students in the School of Business, working with students on their senior capstone projects, and hiring CSUMB graduates.
- Industry experts serve as speakers and panelists at the University's Greater Vision forums (a series of public presentations on topics relevant to local agriculture) and often serve as guest lecturers in classes.

[9] Represents Bearing Acres only; See Grape Production for detail information, Page 12-13
[10] Includes: Apples, Blackberries, Blueberries, Kiwi, Loganberries, Olallaberries, Olives and Walnuts

Grape Production

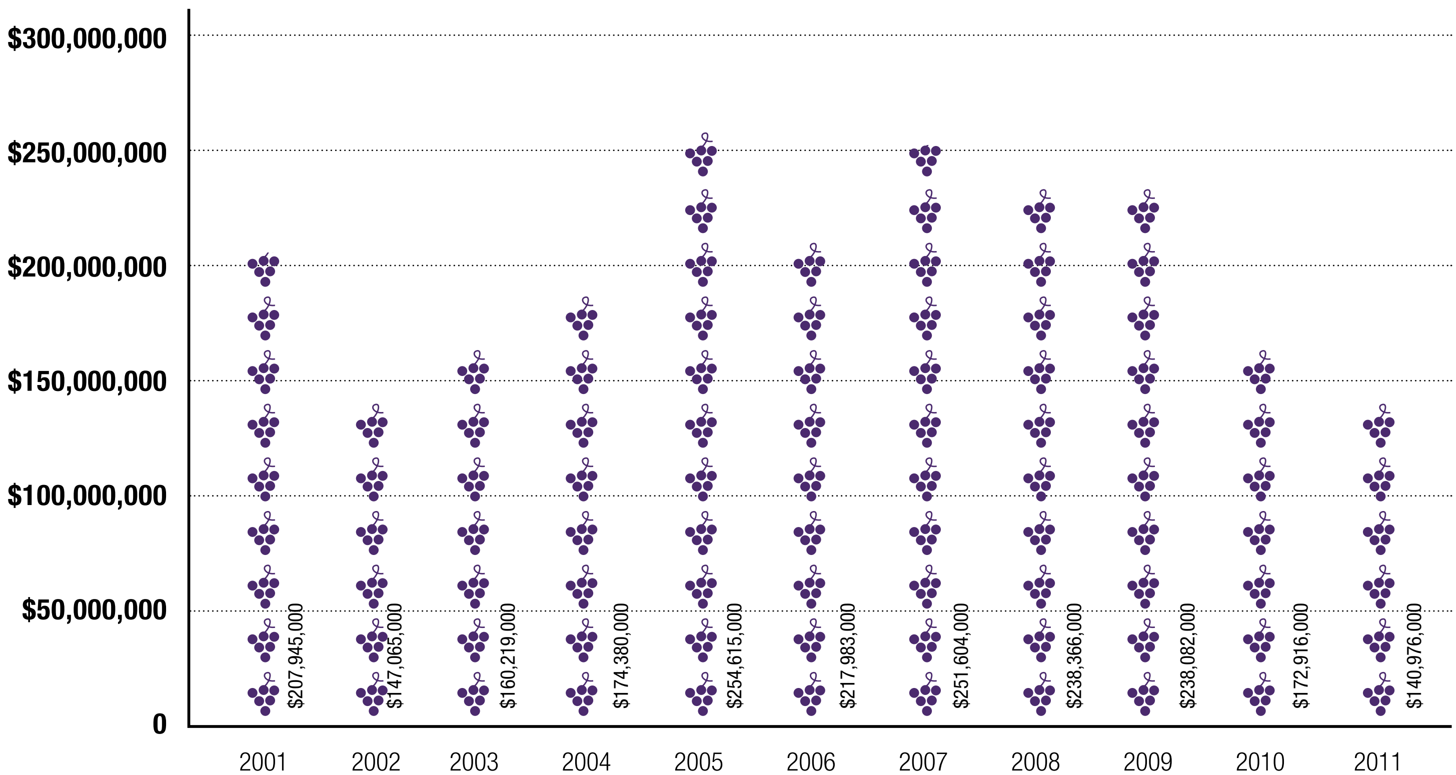
WHITE GRAPE VARIETIES	HARVESTED ACRES	AVERAGE PRICE PER TON	TOTAL TONS	TOTAL VALUE
Chardonnay	16,491	$1,087	42,388	$46,076,000
Riesling	2,116	$937	8,550	$8,011,000
Gewurztraminer	636	$901	4,542	$4,092,000
Pinot Gris	1,499	$986	4,008	$3,952,000
Sauvignon Blanc	1,002	$1,053	3,138	$3,304,000
Other Whites[11]	161	$1,114	594	$662,000
Chenin Blanc	153	$572	999	$571,000
Pinot Blanc	96	$1,723	317	$546,000
Malvasia Bianca	81	$1,158	396	$459,000
Gruner Veltliner	36	$1,020	259	$264,000
Muscat Canelli	55	$898	223	$200,000
Vioginier	149	$1,776	97	$172,000
Roussanne	67	$3,765	42	$158,000
Albarino	34	$1,045	147	$154,000

RED GRAPE VARIETIES	HARVESTED ACRES	AVERAGE PRICE PER TON	TOTAL TONS	TOTAL VALUE
Pinot Noir	7,773	$1,775	18,035	$32,012,000
Merlot	5,544	$955	20,104	$19,199,000
Cabernet Sauvignon	4,370	$943	12,232	$11,535,000
Syrah/Shiraz	1,704	$1,114	4,130	$4,601,000
Petite Sirah	265	$1,099	1,272	$1,398,000
Grenache	105	$1,568	411	$644,000
Petit Verdot	138	$1,811	347	$628,000
Malbec	198	$1,114	535	$596,000
Cabernet Franc	116	$1,070	393	$421,000
Other Reds[12]	65	$1,326	311	$412,000
Zinfandel	61	$1,336	241	$322,000
Valdiguie	30	$1,000	239	$239,000
Sangiovese	54	$1,058	197	$208,000
Tannat	35	$1,238	113	$140,000

[11] Arneis, Grenache Blanc, Marsanne, Muscat Orange, Semillon, Sauvignon Musque, Tocai Friulano, and Vermentio
[12] Aleatico, Alicante, Barbera, Carignane, Cinsaut, Dolcetto, Dornfelder, Mataro, Mouvedre, Muscat Hamburg, Negrette, Pfeffer Cabernet, Primitivo, Ruby Cabernet, Souzao, Tempranillo,Teroldego, Tinta Cao, Tourga Nacinal, Touriga Francesca, and Trousseau

YEAR	NONBEARING ACRES	BEARING ACRES	TOTAL TONS	VALUE
2001	7,888	38,098	184,082	$207,945,000
2002	5,682	37,325	143,947	$147,065,000
2003	2,829	34,287	151,344	$160,219,000
2004	1,036	36,614	172,082	$174,380,000
2005	2,378	38,179	269,000	$254,615,000
2006	3,144	38,165	210,000	$217,983,000
2007	3,068	39,636	224,000	$251,604,000
2008	4,006	40,144	201,000	$238,366,000
2009	3,975	40,792	204,000	$238,082,000
2010	2,572	43,321	177,000	$172,916,000
2011	2,006	43,034	124,000	$140,976,000

Monterey County's Value of Wine Grapes



Field Crops

CROP	YEAR	ACREAGE	PRODUCTION PER ACRE	TOTAL	UNIT	VALUE PER UNIT	TOTAL
Barley, Grain	**2011**	**7,271**	**1.34**	**9,720**	**ton**	**$103.80**	**$1,009,000**
	2010	10,130	1.41	14,300	ton	$92.88	$1,328,000
Beans [13]	**2011**	**721**	**1.23**	**885**	**ton**	**$1,680.43**	**$1,487,000**
	2010	883	1.27	1,120	ton	$1,659.61	$1,859,000
Hay, Alfalfa	**2011**	**217**	**5.39**	**1,170**	**ton**	**$175.00**	**$205,000**
	2010	250	5.63	1,410	ton	$169.88	$240,000
Misc. Field Crops [14]	**2011**	**1,170**	**1.74**	**2,030**	**ton**	**$137.00**	**$278,000**
	2010	1,550	1.94	3,010	ton	$119.60	$360,000
Oats [15]	**2011**	**2,035**	**1.17**	**2,380**	**ton**	**$210.00**	**$500,000**
	2010	2,716	1.87	5, 080	ton	$119.12	$605,000
Wheat, Grain	**2011**	**1,221**	**1.26**	**1,540**	**ton**	**$182.04**	**$280,000**
	2010	1,125	1.25	1,410	ton	$122.60	$173,000
Rangeland	**2011**	**1,066,494**	**N/A**	**N/A**	**acre**	**$12.25**	**$13,065,000**
	2010	1,066,494	N/A	N/A	acre	$10.00	$10,665,000
FIELD CROPS TOTAL	**2011**	**1,079,129**					**$16,824,000**
	2010	1,083,148					$15,230,000

[13] Includes: Peruano, Pintos, Pink, Pinquito, and Lima Beans
[14] Includes: Safflower, Pasture, and Barley
[15] Includes: Hay Oats and Misc. Oats

Seed Production

CROP	YEAR	ACREAGE	PRODUCTION PER ACRE	TOTAL	UNIT	VALUE PER UNIT	TOTAL
Bean Seed, All	2011	2,320	0.89	2,070	ton	$2,096.28	$4,339,000
	2010	2,626	1.04	2,730	ton	$1,807.60	$4,935,000
Misc. Seed[16]	2011	1,739	1.72	3,000	ton	$1,688.42	$5,065,000
	2010	1,630	1.85	3,020	ton	$1,671.78	$5,049,000
SEED PRODUCTION TOTAL	**2011**	**4,059**					**$9,404,000**
	2010	4,256					$9,984,000

Apiary Production

CROP	YEAR	COLONIES	PRODUCTION	UNIT	VALUE PER UNIT	TOTAL
Honey	2011	N/A	24,100	lbs	$1.50	$36,000
	2010	N/A	37,147	lbs	$1.40	$52,000
Pollination[17]	2011	4,200	N/A	colony	$45.00	$189,000
	2010	4,166	N/A	colony	$45.00	$187,000
Wax	2011	N/A	1,125	lbs	$2.35	$2,640
	2010	N/A	1,500	lbs	$2.25	$3,380
APIARY PRODUCTION TOTAL	**2011**					**$228,000**
	2010					$242,000

SPOTLIGHT ON Locally Developed Packaging Technologies

- Many local produce and package supplier companies are working to improve food safety and develop more sustainable packaging alternatives that are safe, reusable and/or recyclable.
- One Monterey County-based company has developed a waxless alternative carton for shipping hydro-cooled or iced vegetable products that is recyclable and is sourced with Sustainable Forestry Initiative (SFI) certified fiber.
- Pallets literally provide the foundation for moving produce from field to table. One locally-based company reuses and recycles nearly 100% of the material in their new and reconditioned wooden pallets.

[16] Includes: Barley, Broccoli, Carrots, Cauliflower, Celery, Corn, Cucumber, Flowers, Kohlrabi, Onions, Peas, Peppers, Radish, Soybean, and Squash.
[17] Seed Crops Pollinated: Broccoli, Carrot, Cauliflower, Cucumber, Flower, Onion, Pepper, Radish, and Squash.

Our community is as rich as the soil, diverse as the crops that grow here.

Agriculture & Our Community

LIVING AND WORKING IN STEINBECK COUNTRY

By Melanie Beretti

Agriculture touches nearly every facet of life in Monterey County. From lettuce in the Salinas Valley, artichokes in Marina, berries in north Monterey County, or vineyards in Carmel Valley, agriculture shapes our lives. Our community is as rich as the soil, diverse as the crops that grow here.

When one drives along Highway 1 between Salinas and the Pajaro River, it is common to see the iconic image of field workers making their way through a fog-blanketed field. By number, the majority of people working directly in agriculture are field workers. But if you take a more careful look at this scene, you will see that the men and women working in the fields bring a valuable, highly refined skill set. Unlike the majority of agriculture across the United States that is machine harvested, the crops grown in Monterey County are dependent upon this highly skilled labor force to produce the fresh fruits and vegetables that feed the nation and keep us healthy.

The vast majority of agricultural companies based in Monterey County are family-owned and operated. The strength of these companies lies with their employees, and creating opportunities for employee advancement and retention is vital. It is this foundation in family and community that makes it possible, for example, for a hard-working person with basic education to work his or her way up within a company.

Such is the story of Jose Luis, told to me on a typical sunny Salinas Valley day. When Jose Luis completed the sixth grade in his hometown in Chavinda, Michoacán, Mexico, his family didn't have the money to pay for any further education for him. They told him they would be able afford the continuance of his studies in a couple of years, once his older brothers completed university. Out of necessity Jose Luis decided to travel to the United States with his neighbors to earn money for his education and family during this time.

As we drive from ranch to ranch down the valley, our conversation is interrupted at least a dozen times with phone calls or field visits to address the day's business. At one point we meet a colleague alongside the road in Gonzalez to inspect a box of romaine lettuce hearts in new-to-market packaging. For all I know, my cousins in Michigan will be eating that lettuce tomorrow. With each interruption, Jose Luis politely excuses himself from our conversation and it strikes me how calm and respectful he is in all his interactions, despite the rapid pace of the produce business. Once business is done, he promptly and smoothly picks up his story where he left off, not missing beat.

His father had owned a farm in Mexico and worked hard to insure his children completed their education. He had worked in the United States as part of the Bracero Program, and knew how difficult life could be for field workers in the U.S. It was with some reluctance that he decided Jose Luis could travel to the US for the summer. Jose Luis began by harvesting raisin grapes in California's Central Valley. The summer came and went, and he continued working the fields moving to Watsonville for the celery harvest – "es un trabajo bien duro." Within a couple of years he was working the lettuce harvest in the Salinas Valley. By age 21, his attention to quality and willingness to tell the honest truth, not just what the boss wanted to hear, got him promoted to Harvest Foreman. More than 30 years later, he oversees all mixed vegetable operations for one of the largest produce companies in the world.

If you ask Jose Luis what he does, he'll modestly tell you that he "talks all day." This hardly describes the role he plays to facilitate the movement of millions of pounds of produce each day, Monday through Saturday, from Salinas Valley fields on their journey to tables throughout the nation and beyond. Working from dawn to dusk, Jose Luis choreographs the workers and equipment moving throughout the fields in response to rapidly changing market and field conditions. In one moment he's evaluating lettuce in the field to determine when it will be ready for harvest. The next he's calculating harvest needs and juggling crew schedules to meet orders for the following week.

However, as his children grew older it became difficult for them to change schools to move south with him. Like his father, Jose Luis is a firm believer in education and wanted his children to have the education that he was not able to obtain. So once his oldest was in high school his family began residing year-round in Salinas while Jose Luis working on the company's operations down south from December until April.

This position has allowed Jose Luis to support his family and put his children through college, but not without great sacrifice. From April through November, production is on the Central Coast. In order to provide fresh produce year-round, operations shift to Yuma, Arizona in December where Jose Luis works until mid-March. From Yuma production shifts to Huron for about a month, then finally back home to the Central Coast. When his children were young, Jose Luis was able to move his family with him so they could be together throughout the year.

Reflecting upon our time together, I am humbled by Jose Luis's story. Yet I am reminded that his story begins the same as so many of the hard working people in the fields up and down the valley. What has helped make Jose Luis exceptional are his simple "keys to success": no matter what you do, strive to be the best; pay attention to details of your trade; put yourself in the customer's/other person's shoes; never make a decision in haste; take time routinely to look up from what you are doing and see the bigger picture; be kind and respectful to others.

Cut Flowers & Cut Foliage

CROP	YEAR	ACREAGE	PRODUCTION QUANTITY SOLD	UNIT	VALUE PER UNIT	TOTAL
Alstroemeria	2011	3.43	61,500	per bunch	$1.64	$101,000
	2010	3.90	66,100	per bunch	$1.63	$108,000
Asiatic Lily	2011	1.66	101,000	per bunch	$4.21	$425,000
	2010	2.38	111,000	per bunch	$4.22	$468,000
Carnations	2011	7.89	3,209,000	per bloom	$0.16	$513,000
	2010	10.76	4,585,000	per bloom	$0.19	$871,000
Chrysanthemums	2011	30.35	2,494,000	per bloom	$0.41	$1,023,000
	2010	26.99	2,218,000	per bloom	$0.43	$954,000
Eucalyptus	2011	77.07	327,000	per bunch	$1.64	$536,000
	2010	75.94	594,000	per bunch	$1.70	$1,010,000
Gerbera	2011	11.54	6,067,000	per bloom	$0.45	$2,730,000
	2010	13.38	8,146,000	per bloom	$0.30	$2,444,000
Iris	2011	11.34	271,000	per bunch	$2.88	$780,000
	2010	11.19	224,000	per bunch	$3.06	$685,000
Miniature Carnations	2011	4.49	117,000	per bunch	$1.39	$163,000
	2010	4.00	117,000	per bunch	$1.42	$166,000
Misc. Cut Flowers & Cut Foliage[18]	2011	243.56	20,158,000	various	$1.81	$36,486,000
	2010	281.75	23,873,000	various	$1.66	$39,629,000
Oriental Lilies	2011	4.64	205,000	per bunch	$9.26	$1,898,000
	2010	4.37	127,000	per bunch	$9.40	$1,194,000
Roses	2011	13.59	5,301,000	per bloom	$0.51	$2,704,000
	2010	14.15	7,884,000	per bloom	$0.34	$2,681,000
Snapdragon	2011	13.97	520,000	per bunch	$3.72	$1,934,000
	2010	19.87	645,000	per bunch	$3.57	$2,303,000
Tulips	2011	2.12	38,700	per bunch	$3.80	$147,000
	2010	2.10	40,000	per bunch	$4.43	$177,000
CUT FLOWERS & CUT FOLIAGE TOTAL	**2011**	**426**				**$49,440,000**
	2010	471				$52,690,000

[18] Includes: Acidanthera, Amarnthus, Anemones, Anthurium, Asters, Azalea, Banksia, Belladona, Bulperum, Calendula, Calla Lily, Coleus, Curly Willow, Cyclamen, Daffodils, Dahlias, Delphinium, Ferns, Freesia, Gardenia, Gladiolus, Godetia, Grasses, Heather, Hydrangea, Impatiens, Kale, Kangaroo Paw, Larkspur, Lavender, Leather Leaf, Leptospermum, Leucodendron, Leucospermum, Limonium, Lisianthus, Marigold, Oxalis, Portulaca, Protea, Ranunculus, Safflower, Scabiosa, Solidacious, Statice, Stock, Sunflower, Sweet Peas, Tuberose, Viburnum,Yarrow, and Zantedeschia

Nursery Products

CROP	YEAR	ACREAGE	PRODUCTION QUANTITY SOLD	UNIT	VALUE PER UNIT	TOTAL
Bedding Plants	2011	157.12	32,786,000	per plant	$0.49	$16,065,000
	2010	169.00	35,415,000	per plant	$0.46	$16,291,000
Misc. Nursery Products[19]	2011	658.38	17,527,000	various	$1.04	$18,228,000
	2010	835.55	33,352,000	various	$0.81	$27,015,000
Orchids	2011	108.40	9,119,000	per plant	$6.69	$61,006,000
	2010	91.01	7,690,000	per plant	$7.34	$56,445,000
Poinsettia	2011	81.23	1,933,000	per plant	$5.35	$10,342,000
	2010	88.40	2,031,000	per plant	$5.68	$11,536,000
Potted Plants	2011	252.77	16,239,000	per plant	$2.97	$48,230,000
	2010	253.91	17,485,000	per plant	$2.72	$47,559,000
Propagative Materials	2011	9.94	2,736,000	per plant	$0.36	$985,000
	2010	12.57	3,234,000	per plant	$0.38	$1,229,000
Vegetable Transplants	2011	80.13	1,585,761,000	per plant	$0.03	$47,573,000
	2010	111.09	2,198,455,000	per plant	$0.02	$43,969,000
Woody Ornamentals	2011	56.73	1,781,000	per plant	$4.96	$8,834,000
	2010	73.63	1,993,000	per plant	$4.71	$9,387,000
Nursery Products Total Acres	2011	1,405	----	----	----	$211,263,000
	2010	1,635				$213,431,000

OVERALL NURSERY[20] TOTAL	**2011**	**1,831**	**$260,703,000**
	2010	2,106	$266,121,000

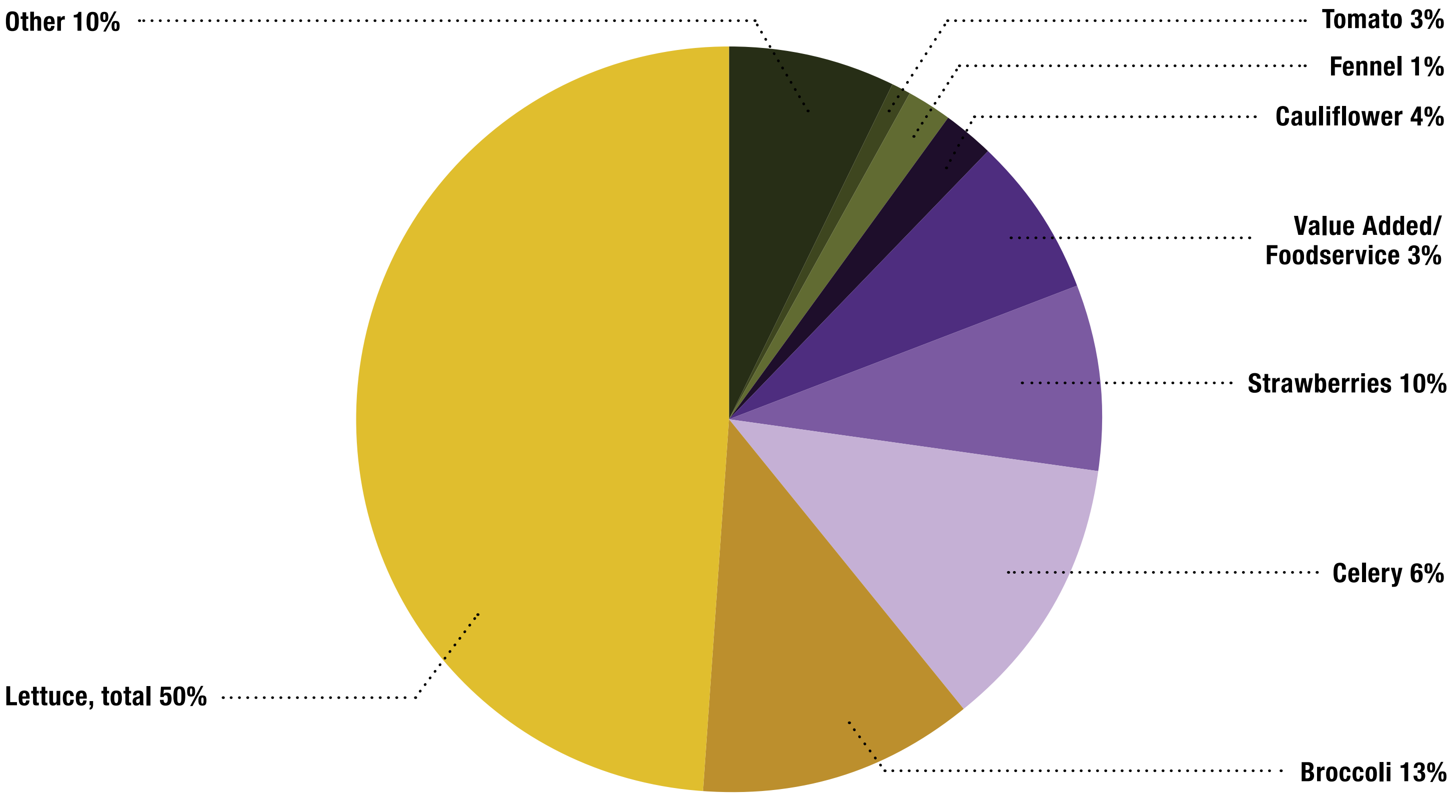
Livestock & Poultry

CROP	YEAR	HEAD	PRODUCTION	UNIT	VALUE PER UNIT	TOTAL
Cattle & Calves	2011	43,250	314,000	cwt	$124.75	$39,172,000
	2010	43,000	280,000	cwt	$112.00	$31,360,000
Stocker	2011	46,000	144,000	cwt	$37.00	$5,328,000
	2010	45,400	136,000	cwt	$64.00	$8,704,000
Sheeps & Lambs	2011	2,200	3,750	cwt	$92.00	$345,000
	2010	2,200	3,750	cwt	$90.00	$338,000
Hogs	2011	1,450	319,000	lbs	$0.65	$207,000
	2010	1,450	290,000	lbs	$0.55	$160,000
Wool	2011	N/A	15,500	lbs	$0.40	$6,200
	2010	N/A	16,000	lbs	$0.40	$6,400
Misc. Livestock[21] & Poultry[22] Products	2011	----	----	----	----	$9,410,000
	2010					$9,325,000

LIVESTOCK & POULTRY TOTAL	**2011**	**$54,468,000**
	2010	$49,893,000

[19] Includes: Begonia, Bromeliads, Bulbs, Christmas Trees, Clivia, Corms, Cypress, Euonymus, Ficus, Fruit & Nut Trees, Jasmine, Milkweed, Myrtle, Native Plants, Rhizomes, Tubers, Turf, and Water Pond Plants
[20] Totals from Cut Flower & Cut Foliage and Nursery Products
[21] Includes: Bulls, Cull Cows, Dairy Cows, Milk Manufacturing, and Market Milk
[22] Includes: Eggs, Fertilizer, Hatcheries, and Poultry

Monterey County's Produce Exports by Commodity



2011 Exported Commodities

Lettuce
378,847,370 lbs

Broccoli
95,016,422 lbs

Strawberries
79,568,870 lbs

Celery
46,037,040 lbs

Cauliflower
30,511,074 lbs

Food Service
25,529,839 lbs

Tomatoes
21,536,050 lbs

Seeds
3,592,032 lbs

Brussels Sprouts
1,369,500 lbs

Asparagus
1,118,421 lbs

Artichokes
528,803 lbs

Other
71,686,930 lbs

Total 759,637,787 lbs

2010 Exported Commodities

Lettuce
279,885,294 lbs

Broccoli
68,476,024 lbs

Celery
64,775,591 lbs

Strawberries
43,562,501 lbs

Food Service
41,740,578 lbs

Cauliflower
10,223,026 lbs

Nursery Stock*
9,942,092 lbs

Anise/Fennel
6,607,745 lbs

Tomatoes
5,638,325 lbs

Asparagus
4,425,024 lbs

Artichokes
3,806,369 lbs

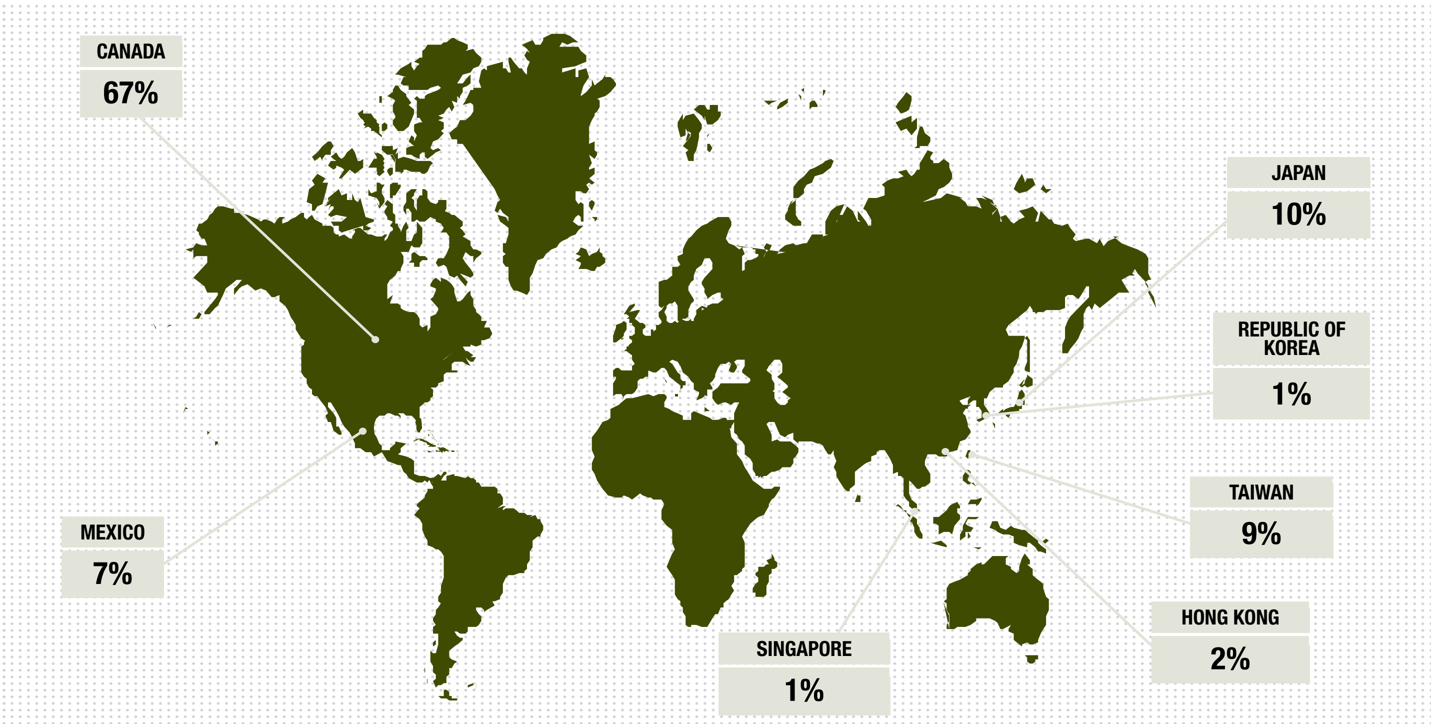
Brussels Sprouts
2,768,150 lbs

Other
21,002,303 lbs

Total 562,853,022 lbs

* Nursery crop exports are now reported separately on page 22

Monterey County's Agricultural Exports Trade Partners



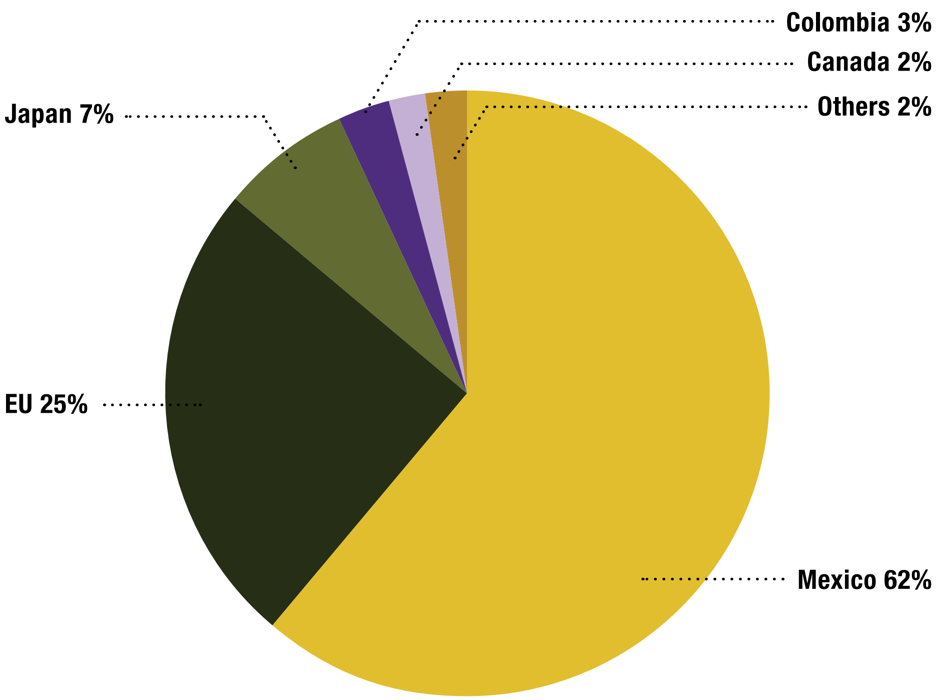
2011 Total Lbs

Canada	**529,832,678**
Japan	**83,067,575**
Taiwan	**68,836,954**
Mexico	**53,248,151**
Hong Kong	**16,873,873**
EUN	**15,487,080**
Republic of Korea	**7,779,993**
Singapore	**9,514,353**
Puerto Rico	**2,896,582**
United Arab Emirates	**1,903,596**
Panama	**1,544,783**
New Zealand	**797,608**
Kuwait	**503,611**
Saudi Arabia	**321,732**
Australia	**311,262**
Baharian	**143,904**
Brazil	**132,390**
Qatar	**108,408**
French Polynesia	**77,004**
Phillipines	**68,088**
Guatemala	**36,119**
Indonesia	**29,550**
South Africa	**24,336**
Chile	**5,134**
Colombia	**1,154**
Costa Rica	**20**

2010 Total Lbs

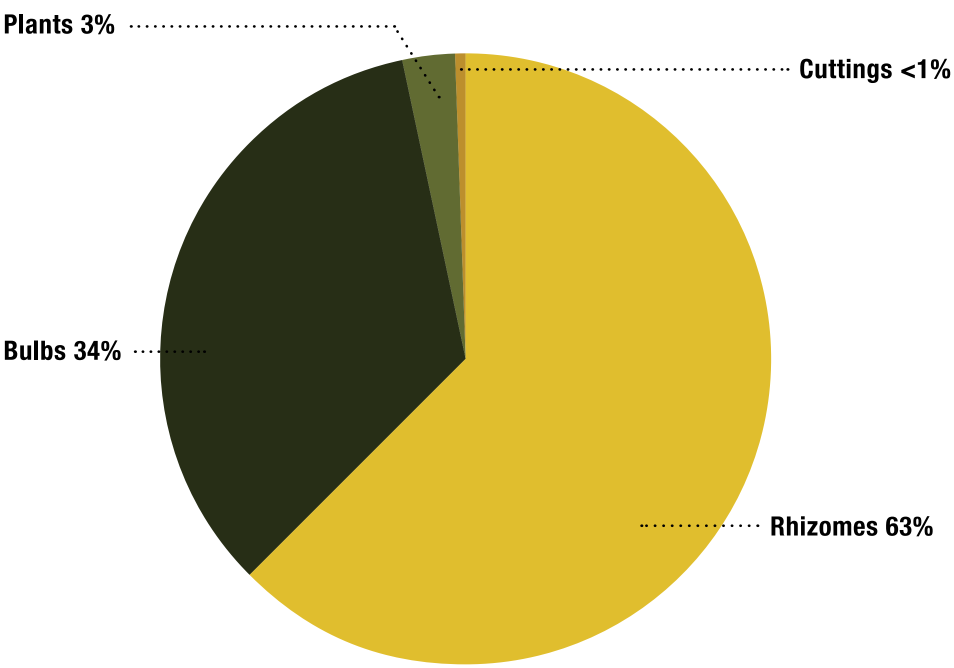
Canada	**309,014,346**
Taiwan	**61,600,448**
Mexico	**38,268,100**
Japan	**29,951,757**
Hong Kong	**19,538,949**
Republic of Korea	**6,578,162**
Singapore	**6,216,406**
Puerto Rico	**4,855,19**
EUN	**3,601,004**
Kuwait	**2,169,321**
United Arab Emirates	**1,421,302**
Panama	**889,018**
Malaysia	**787,020**
Switzerland	**589,440**
Saudi Arabia	**546,000**
New Zealand	**487,855**
Australia	**471,346**
Colombia	**328,581**
Qatar	**104,964**
Guatemala	**94,775**
Brazil	**56,742**
French Polynesia	**48,342**
Indonesia	**29,016**
Republic of China	**25,837**
Bahrain	**18,942**
Costa Rica	**13,962**

Monterey County's Nursery Exports by Units



COUNTRY	UNITS
Mexico	17,965,401
EU*	7,141,584
Japan	1,926,111
Colombia	728,806
Canada	698,980
Republic of Korea	217,950
China	87,660
Guatemala	61,500
South Africa	59,660
Taiwan	48,600
Chile	43,898
Jordan	40,800
Ecuador	30,170
Costa Rica	20,695
Tanzania	17,600
Kenya	15,030
New Zealand	9,510
Norway	8,250
Jamaica	4,450
Dominican Republic	3,000
Sri Lanka	2,880
Vietnam	2,410
Australia	1,331
Brazil	1,040
Fiji	490
Barbados	325
TOTAL	**29,138,131**

Monterey County's Nursery Exports by Category



UNITS	NUMBER
Rhizomes	18,281,595
Bulbs	9,886,129
Plants	824,504
Cuttings	144,488
Flowers	496
In vitro plantlets	488
Plantlets	431
TOTAL	**29,138,131**

* EU includes Denmark, France, Germany, Netherlands, UK, Portugal, Italy, Spain

Summary Of Sustainable Agricultural Activities

COUNTY BIOLOGICAL CONTROL

	AGENT / MECHANISM	SCOPE OF PROGRAM
Yellow Starthistle*, Centaurea solstitialis	Seedhead Weevils/Fly,	47 Sites
Italian Thistle, Carduus spp.	Bangasternus orientalis, Eustenopus villosus	General Distribution
Russian Thistle, Salsola australis	Urophora sirunaseva, Larinus curtus,	7 sites
Puncture Vine, Tribulus terrestris	Seedhead weevil, Rhinocyllus conicus	General and Local Distribution
Aphid species	Leaf & stem mining moths, Coleophora spp.	1 site
Ash Whitefly, Siphoninus phillyreae	Stem & Seed weevils, and Microlarinus spp.	General Distribution
	Seven-spotted lady beetle, Coccinella septempunctata	
	Parasitic wasp, Encarsia inaron	

* The hairy seedhead weevil, Eustenopus villosus, is available for release to individual properties with yellow starthistle infestations. Call for arrangements.

PEST ERADICATION

Scotch Thistle, Onopordum acanthium	Mechanical/Chemical	One Infestation
Skeletonweed, Chrondrilla junceae	Mechanical/Chemical	Two Infestations
Puna Grass, Achnatherum brachychaetum	Mechanical/Chemica	Nine Infestations

Hydrilla (Hydrilla verticillata), and biddy-biddy (Acaena novae-zelandiae) have been eradicated.

PEST MANAGEMENT

Roadside (virus host) Weeds	Chemical	County right-of-ways, spot treatment
Roadside, Targeted Noxious Weeds	Chemical	County right-of-ways, boom and spot treatment
Lettuce Mosaic Virus	Virus-Free Seed	Indexing of all county-planted seed
Lettuce Mosaic Virus	Host-Free Period	No lettuce above ground 12/7-12/21
Celery Mosaic Virus	Host-Free Period	No celery above ground in January
Lettuce Root Aphid	Quarantine, State Misc. Ruling 3597	Lombardy poplar prohibition

PEST DETECTION / EXCLUSION

Pest detection is the systematic search for pests outside of a known infested area, or for pests not known to occur in California. The general goal is to detect pests before they become established over an area so large that eradication is no longer biologically or economically feasible. Pest exclusion refers to the process of denying entry of pests into an area by routine inspection of incoming plant shipments and rejection of infested material. Detection trapping is performed primarily by the County Agricultural Commissioner's offices.

TARGET PESTS	INSECT HOSTS	NO. OF TRAPPED SERVICINGS
Medfly	Fruit Trees	3,430
Melon Fruit Fly	Vegetable Gardens	1,072
Mexican Fruit Fly	Fruit Trees	2,792
Oriental Fruit Fly	Fruit Trees	1,484
Misc. Fruit Flies	Fruits and Vegetables	1,076
European Corn Borer	Grains and Vegetables	34
Gypsy Moth	Shade Trees	1,244
Japanese Beetle	Turf, Roses	1,187
Trogoderma Beetle	High Hazard Commodities	16
Glassy Winged Sharpshooter	Nurseries/Vineyards/Urban Areas	15,417
Light Brown Apple Moth	Ornamental/Commercial Crops	5,474
Pepper Moth	Ornamental/Commercial Crops	2
European Grapevine Moth	Grapes	44,355
Asian Citrus Psyllid	Citrus	3,061
Nantucket Pine Tip Moth	Conifers	35

Pest detection trapping activities accounted for 10,761.5 hours, with a total of 80,679 trap services being made. Two hours were applied to inspecting 5 commercial crop sites of 1.5 net/ 75 gross acres. Two calls to residences were made for investigation of suspect reports and 65.5 hours were utilized on inspection/identification of public-reported pests. Twenty-seven high hazard locations were inspected and 241 miles of entryways surveyed, accounting for 52.5 and 34.5 hours respectively. Special surveys were made for exotic invasive weeds, Africanized honeybee, Karnal bunt, mint beetle, citrus greening disease, sudden oak death disease, Asian citrus psyllid, and glassy-winged sharpshooter.

ORGANIC FARMING

One hundred thirteen farms, totaling approximately 19,863 acres of crop land and 9,929 rangeland, were registered in Monterey County in 2011. Utilizing organic principles defined in the California Organic Food Act of 2003, these farms produce a wide array of commodities, such as: strawberries, spinach, broccoli, salad mix, celery, lettuces, cauliflower, raspberries and miscellaneous vegetables. The total estimated value of organic production in Monterey County during 2011 was $170,352,183. This compares with 2010 where we had 19,495 production acres and 9,000 acres of rangeland with an estimated value of $168,956,060.

Monterey County
Agricultural Commissioner's Office
1428 Abbott Street, Salinas, CA 93901

831.759.7325 • http://ag.co.monterey.ca.us

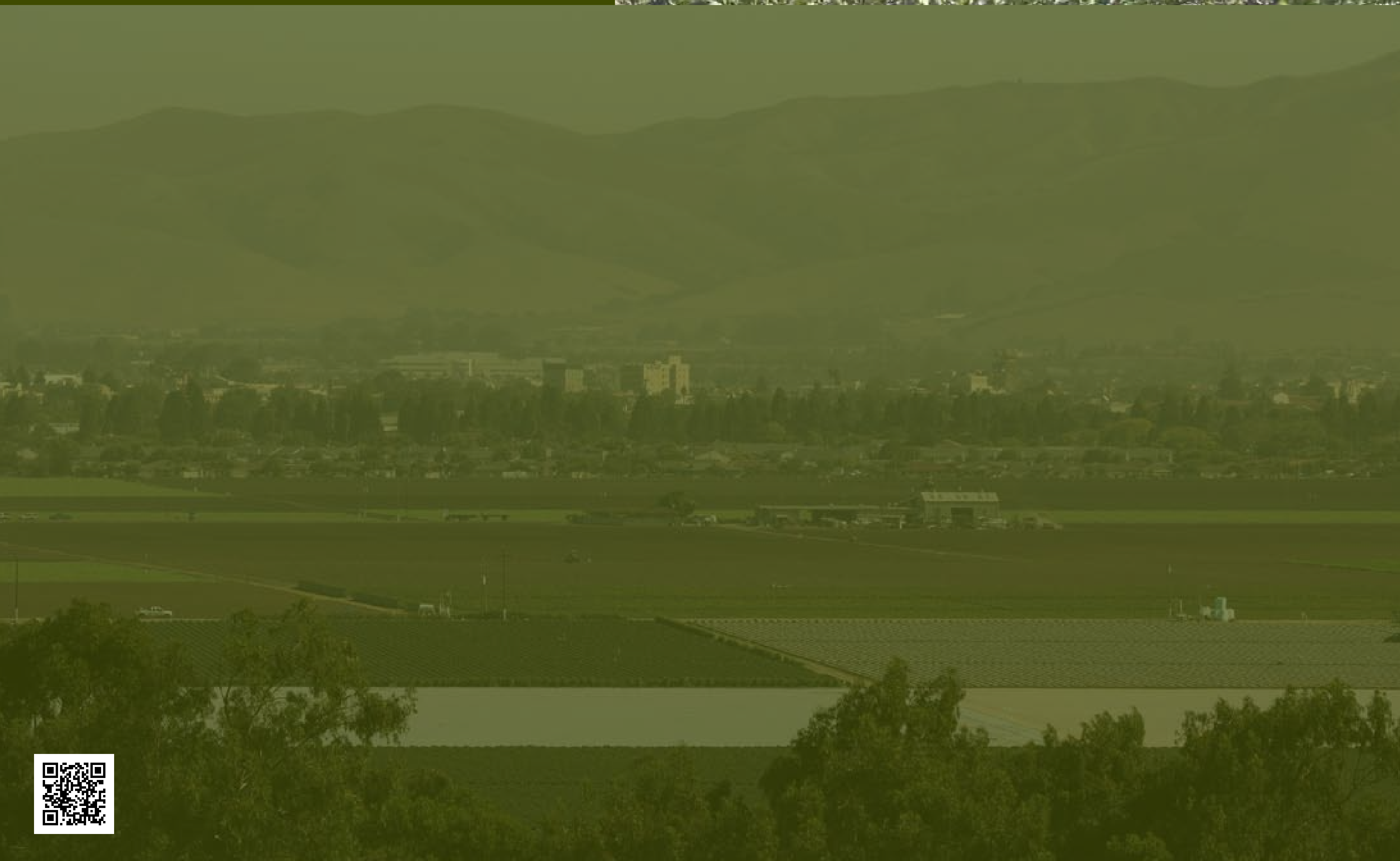


Exhibit 31

Michael Thomas **August 2012**
629 Santa Lucia Ave
Los Osos, CA 93402
(805) 748-6762

Education

College:	College of Environmental Science and Engineering, University of Florida
Major:	Environmental Science and Engineering
Graduated:	May of 1987 (Bachelor Degree).

Career Experience:

Assistant Executive Officer, Central Coast Water Board, San Luis Obispo, CA.
2005 to Present:

Oversee approximately 70 employees for the Central Coast Water Board, which regulates many types of land use activities and discharges to land, surface waters, and groundwater, over approximately 11,000 square miles of the Central California Coast. This includes thousands of individual cases in several areas, including:

Municipal development, land uses, and storm water
450,000 acres of Irrigated agriculture
2.3 million acres of cattle grazing
Municipal and hazardous waste landfills
Timber harvesting
Groundwater and surface water cleanup projects
Dredging in harbors
Power plants

Oversee tens of millions of dollars in grants for all types of water resource projects, including habitat conservation and restoration.

Leading the Water Board's effort to be a performance-based organization focused on tangible results in the physical world. This cultural change effort is based on collaboration and teamwork throughout and across the organizational structure. The goal is to grow a culture that rewards actions to achieve tangible progress on the most important and controversial water issues on the Central Coast. This includes implementing the following:

Using a grass-roots process to establish a vision, goals, and objectives for the organization
Establishing values for the organization
Revising our recruiting, interviewing, hiring, and "graceful exit" processes
Establishing higher order, written expectations for all employees
Providing ongoing leadership education for all employees
Measuring important factors to demonstrate progress (and define the culture)
Defining success and failure
Encouraging and rewarding risk taking to achieve greater tangible results

We implemented unprecedented actions to address the major water quality issues on the Central Coast, such as:

> *Defined prioritization criteria based on water quality and threat to human health, and applied it to all our work across the organization to make sure we are focused on the most important issues.*
>
> *Defined job expectations for all Water Board staff based on our goals and priorities.*
>
> *Created and funded the Central Coast Low Impact Development Initiative (http://centralcoastlidi.org/Central_Coast_LIDI/Home.html, which provides expert design and planning services on all aspects of sustainable development to municipalities and consultants.*
>
> *Developed new regulations for irrigated agriculture to address the most severe and challenging water quality problems on the Central Coast, which are also among the most severe problems in the United States.*
>
> *Ongoing development of advanced requirements for municipal storm water management, such as hydromodification control criteria and low impact development design standards.*
>
> *Created a performance based structure and tracking system for our grant management program to achieve accountability for tangible results on our priority issues.*
>
> *Implemented "Vision Teams," which are led by line staff and are designed to work across the organizational structure to define and implement actions that help achieve our vision, goals, and objectives.*

Executive Leadership Teaching

I currently teach several classes in the UC Davis Executive Program, including:

Mental Models
Leading Change
Leadership Communication
Navigating Complexity
Leadership Styles and Efficacy
Ethics
Case Studies

The UC Davis Executive Program is described here:
http://extension.ucdavis.edu/unit/business_and_management/executive_program/

As part of the UC Davis Executive Program, I teach classes am assisting other Regional Water Boards in their efforts to become more performance based organizations (References: David Gibson, Executive Officer, San Diego Regional Water Board; Catherine Coleman, Executive Officer, Santa Rosa Regional Water Board).

June 1987 to January 2005: State of CA, Regional Water Quality Control Board, San Luis Obispo, CA, Program Manager and Project Manager.

1995 to 2005:

I was the project manager overseeing engineering evaluations, ecological impact studies, mitigation analyses, and socio-economic studies related to three major power plants in the Central Coast Region. These projects included some of the most complex and comprehensive work ever undertaken by the Water Board. I directed a technical workgroup that designed and implemented ecological studies at the Diablo Canyon Nuclear Power Plant; studies that defined the standard that is now followed by other similar work. I initiated the use of third party, independent scientific oversight, hired and managed ten independent PhD level scientists and three consulting firms, and managed multi-disciplinary technical workgroups to oversee all aspects of the engineering, ecological, and economics work.

The biological studies at Diablo Canyon are among the most comprehensive marine impact studies of their type in the world (Reference: Pete Raimondi, UC Santa Cruz). During a deadlock among scientists on the technical workgroup regarding interpretation of ecological impacts, I initiated the concept of interpreting impacts as "effective habitat loss," which is now being used throughout the United States on power plant projects and is referenced in new Clean Water Act regulations. I initiated unique solutions to environmental impacts, including habitat restoration and conservation in coordination with achieving the Water Board's ultimate goal of water quality protection on a watershed and regional level scale. A proposed settlement of the Diablo Canyon Power Plant impacts currently includes permanent ecological preservation of 4 miles of coastline habitat and 2000 acres of coastal watershed, and approximately $6 million dollars for marine projects. I initiated discussions with the non-profit Resources Legacy Fund Foundation and negotiated an additional $2.5 million matching grant for this project.

I initiated, negotiated, and defended a $7 million mitigation package to resolve impacts caused by the Moss Landing Power Plant, and directed the funds toward restoration and conservation. The project has so far produced the permanent preservation of over 2000 acres of habitat around the Elkhorn and Moro Cojo Sloughs, and restoration of hundreds of acres of wetlands—one of the most successful conservation projects of its kind in California (Reference. Mark Silberstein, Elkhorn Slough Foundation).

1994-1995:

I was the acting Supervisor of the Regional Board's Planning Unit. I managed several full time employees and student interns. My responsibilities included oversight of large scale monitoring programs, training workshops, grant programs, budgeting, Basin Plan amendments, and presentations and recommendations before the Regional Board.

1990–1994

I worked primarily on non-point source issues, managing several programs:

- Timber Harvest Program
- Toxic Substances Monitoring Program
- Mussel Watch Program
- Bay Protection and Toxic Cleanup Program
- 205j Grant Program
- 319h Grant program
- Clean Lakes Grant Program

- Contract management and oversight of grant project implementation

Major projects during this time were:

Buena Vista Mine:

Project manager investigating mercury pollution in the Lake Nacimiento watershed. I managed a watershed scale mercury loading study that changed the agency's approach to regulating this facility and resulted in the site being accepted into the federal Super Fund Program.

Monterey Harbor Lead Investigation/Cleanup:

Project manager investigating lead pollution in Monterey Harbor. This case presented major political obstacles and had been stagnant for nine years. After taking over as project manager, I addressed each obstacle in turn and within eight months Southern Pacific Railroad was on-site completing a major hazardous waste cleanup operation at a cost of over $5 million.

1987-1990

I worked primarily on groundwater pollution cases. These projects included geological and engineering reviews. Some of my major projects during this time were:

Unocal, Guadalupe:

Project manager overseeing investigation of a massive subsurface oil spill in the Guadalupe dunes. This is one of the largest oil field cleanup projects in the United States, costing hundreds of millions of dollars.

Unocal, Avila Beach:

Initial project manager overseeing investigations into extensive subsurface oil spills beneath a large portion of Avila Beach. Much of the town was excavated, costing in the hundred million dollar range.

Development Courses

Professional Development Education

UC Davis Executive Program (UC Davis 2006/7)
Strategic Management (Harvard Kennedy School of Government, 2006)
Coaching Skills for Managers and Supervisors
Leading Change
The Art and Science of Leadership
The Work of Leadership
Harnessing Complexity
How to Supervise People
Leadperson Workshop
Managing Multiple Priorities
Powerful Business Writing Skills
Evelyn Wood Reading Dynamics
Proofreading and Grammar Skills
How to Handle Conflict, Anger, and Emotion
Interpersonal Communication Skills
How to Solve Communication Problems
Presentations with Confidence and Power
Franklin Quest Time Management
First Things First (Stephen Covey)
Facilitating and Mediating Effective Environmental Agreements (Concur)
Negotiating Effective Environmental Agreements (Concur)

Technical Development Training:

River and Stream Morphology
Comprehensive Watershed Evaluations
GIS Training Seminar
State of the Estuary— Morro Bay (Presenter)
Contract Management
Estuarine Research Seminar
Marine Bioassay Workshop
Bioremediation- Soil and Ground Water
Data Base Management
Conservation Planning on the Central Coast (Resources Legacy Fund Foundation)
Ecosystem Based Management (COMPASS, Packard Foundation)

Angela Schroeter

EXPERIENCE **Senior Engineering Geologist/Program Manager** **August 2006 to Present**

Central Coast Regional Water Quality Control Board
Agricultural Regulatory Program

Supervise technical staff and manage the implementation of the Agricultural Regulatory Program Unit. Develop, maintain, and implement permit (Conditional Waiver of Waste Discharge Requirements) for irrigated agriculture. The Agricultural Regulatory Program implementation includes managing enrollment of individual farms, prioritizing individual farms based on relative risk to water quality, degree of waste discharge, and proximal water quality impairment; evaluating compliance based on management practice implementation and monitoring and reporting; and conducting enforcement. The program also coordinates with an external cooperative monitoring program for surface receiving water implemented by dischargers. Agricultural Regulatory Program data and information is managed in the Water Board's GeoTracker system. Current duties also include managing individual staff from the Waste Discharge Requirement (WDR) Program. From August 2006 to approximately August 2008, duties also included managing the Grants Program, Total Maximum Daily Load Program (TMDL), and Basin Planning.

Senior Engineering Geologist/Program Manager **April 2001 to August 2006**

State Water Resources Control Board
Groundwater Ambient Monitoring and Assessment Program (GAMA) Unit

Supervised the GAMA Unit and managed the implementation of the GAMA Program, a comprehensive statewide groundwater quality monitoring program. GAMA Program components include Statewide Basin Assessments (focuses on public supply wells), the Voluntary Domestic Well Assessment Project (focuses on private domestic wells), and Groundwater Special Studies. The GAMA Program utilizes innovative, state-of-the-art sampling and analytical techniques to test for a broad suite of chemical constituents at very low detection limits. Samples are analyzed for major ions, trace elements, nutrients, volatile organic compounds (VOCs), pesticides, pharmaceuticals, and emergent contaminants (e.g. perchlorate). Naturally occurring isotopes (tritium, carbon-14, and helium-4) are also measured to identify the source and age of the sampled groundwater. Data is used to assess the current status of groundwater quality, to detect changes or trends in groundwater quality, and to assess the natural and human factors that affect groundwater quality. GAMA Program implementation includes coordination of Water Board technical staff and researchers from the U.S. Geological Survey, Lawrence Livermore National Laboratory, and University of California using nearly $50 million in contracts. Additional coordination includes developing partnerships with local water agencies, State and Regional Board programs, and other stakeholders through extensive public meetings to promote inter-agency coordination and data sharing.

Associate Engineering Geologist **September 2000 to March 2001**

State Water Resources Control Board - Groundwater Special Studies Unit

Coordinated an inter-agency task force and public advisory program to design the GAMA Program, in response to the Groundwater Quality Monitoring Act of 2001. Served as GAMA Program lead technical staff person and help plan, organize, direct, and review the work of unit staff to accomplish GAMA Program goals. Reviewed and evaluated hydrogeologic reports and data related to ambient groundwater quality and contamination. Reviewed proposed legislation affecting water quality issues and prepared bill analyses and legislative concept papers. Served as the Division's GIS and GPS contact. Assisted in the management of the Land Disposal Section's student assistants.

Associate Engineering Geologist **September 1998 to August 2000**

State Water Resources Control Board - Land Disposal Unit

Acted as the SWRCB Land Disposal Program liaison for Regions 1 (North Coast), 3 (Central Coast), and 4 (Los Angeles). Provided technical and procedural guidance related to the state Title 27 and federal RCRA programs. Assisted Regional Board staff and other agencies in the implementation and interpretation of statewide policy and regulations. Reviewed and evaluated Report of Waste Discharge, Waste Discharge Requirements, and Self-Monitoring Reports. Evaluated petitions of Regional Board actions and reported analysis, findings and recommendations in technical reports to management. Reviewed and tracked hazardous waste sites under Resolution No. 92-49.

Technical Team Leader – Geologist **August 1997 to August 1998**

U.S. Army Corps of Engineers, Sacramento District - Environmental Engineering Section

Served as the Technical Team Leader for the Basewide Petroleum Program at the Presidio San Francisco. Coordinated state and federal regulators, Corps of Engineers technical staff, and military officials regarding petroleum site investigation and remediation. Negotiated site cleanup with land use authority and directed contractors to conduct investigation and remediation activities. Reviewed remedial and corrective action plans and reports for technical validity and consistency with state and federal policies and regulations. Participated in public meetings, including the Presidio Restoration Advisory Board.

Geologist **June 1994 to July 1997**

U.S. Army Corps of Engineers, Sacramento District - Environmental Engineering Section

Independently organized and conducted hydrogeologic studies in the Honey Lake Basin, including Sierra Army Depot, to investigate regional groundwater movement, occurrence, quality, and supply, including the collection, analysis, interpretation, and management of hydrogeologic data. Coordinated field teams. Prepared reports.

LICENSES **California Professional Geologist**

EDUCATION **M.S. Hydrogeology and Hydrology** ♦ August 1997

B.S. Geology ♦ March 1994

B.S. Environmental Policy Analysis and Planning ♦ March 1994

Silvia Monica Barricarte

Education

- B. S. in Agronomy. University of Buenos Aires. Argentina. 1995. Undergraduate thesis title: “Study of the Salinity on Soils in the West of the Province of Buenos Aires, Evaluating the Influence of the Water Table”.
- Master of Science in General Agriculture with emphasis in Irrigation. Graduated from Cal Poly State University, San Luis Obispo, California. 1999. Graduate Thesis Title: “Comparing Actual with Design Distribution Uniformities on Drip and Microirrigation Systems”.
  Major Professor: Dr. Burt. Director of the Irrigation Training and Research Center, Cal Poly.

Experience

Present.
- Water Resources Control Engineer for the Central Coast Water Quality Control Board since March 2008. Development of the regional “Irrigation and Nutrient Management Program” to reduce surface water irrigation runoff and the off-site movement of nutrient fertilizers from irrigated lands.
  Currently working under the Agricultural regulatory Program to regulate discharges from Irrigated Agricultural Lands of the Central Coast, CA.
- Vineyard Irrigation instructor at Allan Hancock College, Santa Maria community college, since Fall 2007. The irrigation class includes the following topics: irrigation system efficiency (Distribution Uniformity), irrigation scheduling and systems maintenance.

Government.
- Water Resources Specialist for the Cachuma Resource Conservation District, non-profit special district of the Santa Barbara County, California, from June 2001 to February 2008. Water Conservation plans and reports were performed for land users of the California Central Coast, including GIS mapping and database management, AutoCad drafting, and GPS land positioning equipment.
  “Irrigation Mobile Lab” engineer, main duties included: field inspections and evaluations of urban and agricultural irrigation systems, assessment of water management and conservation plans, field measurements, hardware inspection, and calculation of water application amounts and irrigation system efficiencies.
- Instructor and curricula developer of the “Green Gardener” educational program, Central Coast of California.

Private.
- Land and crop capabilities assessment of over 800 hectares at Ranch La Taba, Buenos Aires, from March to May 1996, Argentina. Mapping and planning of land capabilities, soil problems, and conservation practices.
- Irrigation systems designer, technical assistant and engineer duties performed for Irrigation Concepts, private company located in McFarland, Central Valley, California, USA, from June 1999 to June 2001. More than 50 drip and micro-irrigation systems designs made using AutoCad, the engineering drafting computer program. Also, in-field irrigation systems evaluations and hands-on recommendations were given to the ranchers.

Summer Internships.

Irrigation System Evaluations in the San Joaquin Valley (6/97–8/97), and Sacramento Valley (6/98–8/98) in California. The U.S. Bureau of Reclamation sponsored the internships. The evaluations involved drip, microsprays, furrows and sprinklers irrigation systems. The internships were coordinated and organized the ITRC (Irrigation Training and Research center, Cal Poly. San Luis Obispo).

Previous University Related.

Teaching assistant for the Soils Department, University of Buenos Aires, Argentina, from September 1993 to March 1996. Duties: teaching lectures on soil related subjects, laboratory training on soil and water analysis measurement, and on-farm soils structure assessment and land capability evaluations.

Outreach.

- Spanish and English workshops for farmers and irrigators given in partnership with the Central Coast Vineyard Team, non-profit organization located in the Central Coast Region of California; the UC. Cooperative Extension from Santa Barbara and San Luis Obispo counties; the Southern San Luis Obispo and Santa Barbara counties watershed coalition; and the California Strawberry Commission.
- Classes and workshops for the State Water Agency located in the Santa Barbara County, California.
- Special presentations performed for private organizations like the Wine and Grape California Association.
- Workshops and training classes for landowners with landscape and agricultural water use systems through farm advisors of Santa Barbara and Ventura Counties, California.

Special Knowledge and Certifications

- Bilingual in English and Spanish.
- Computer skills: Word, Excel (spreadsheets), Autocad, AutoCivil, GPS equipment and ArcView GIS 3.2 and ArcMap GIS.
- IA Certified Irrigation Designer for Drip and Micro-Irrigation systems and Certified Irrigation Specialist. Certifications achieved through the United States Irrigation Association in 1999.
- California and International Certified Crop Adviser achieved through the American Society of Agronomy and the Soil Science Society of America in April 2009.
- Committee member of the SIP, Sustainability in Practice, Certification Program, since 2008.

Operation and Ranch Information

AW	Operation Name	Current Ranches	Total Acreage	Status
1761	Boutonnet/Laguna Mist Farms	21	3,377.7	Enrolled
1877	Sea Mist Farms	24	4,547.1	Enrolled
1804	RC Farms, LLC	12	3,761.85	Enrolled
1350	Uesugi Farms	19	449.6	Enrolled
1204	Bob Campbell Ranches	27	2,416	Enrolled
1807	Anthony Costa & Sons	7	2,280.3	Enrolled
4609	Costa Farms	12	1,466.46	Enrolled
4610	Costa Family Farms	19	1,763.8	Enrolled
1823	Christensen and Giannini	19	3,751.6	Enrolled
1793	Rio Farms	11	3,608.3	Enrolled
1183	B&D Farms	6	399.6	Enrolled
1818	Jensen Family			No response to NOV issued 9/2011

Note: Enrollment data (from Notice of Intent) is available for these farms. It is not included in the exhibits because information related to specific address and location may not be disclosed due to potential conflict with California privacy laws. In addition, information related to specific irrigation type may not be disclosed because such information may be trade secret and therefore may not be made available for inspection by the public (Wat. Code, § 13267, subds. (b)(2).) Information related to specific crop type may not disclosed because the PRA provides an exception for the disclosure of records that contain “plant production data and similar information relating to utility systems development, or market or crop reports, that are obtained in confidence from any person.” (Gov. Code, § 6254, subd. (e).)