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2018 Year in Review

2018 Sets Stage for Tumultuous 2019

There was a guarded sigh of relief when the new General Order for the Eastern San Joaquin region was adopted by the State Water Resources Control Board on February 4, 2018. Guarded because all knew there were new reporting requirements in store for growers and that sampling of domestic wells for nitrate will begin in 2019.

Less noticed was the adoption on May 31, 2018 of a new Basin Plan Amendment (BPA) for salt and nitrate management by the Central Valley Regional Water Quality Control Board. ESJWQC staff and attorneys have been involved with development of this BPA for more than eight years. Growers know little about what the BPA means for them because important details were uncertain until the final adoption hearing. The BPA faces its final test when it is considered by the State Water Board in April 2019. If adopted, it sets the stage for an aggressive program to address nitrates in groundwater (see pages 19 – 20).

Other stage setting events occurred in 2017 and 2018 when the Office of Enforcement, an independent arm of the State Water Board, issued threats of legal actions against growers in Salinas Valley and Tulare County if they didn't create replacement drinking water programs for local residences whose wells were impacted by excessive nitrate. At press time a settlement agreement was in the works between the State Water Board and Tulare County growers to address water supplies for rural residences in areas of high groundwater nitrates. Salinas Valley growers are in year two of a program where they pay for bottled water deliveries to residences on wells with nitrate above the drinking water standard.

Grower groups in both regions investigated all legal strategies to push back against the actions taken by the Office of Enforcement. In the end, the best attorneys and lobbying in Sacramento were unsuccessful in changing the outcome: the growers are going to pay for replacement water.

The ESJWQC Board of Directors was informed recently that the Office of Enforcement was targeting next the high nitrate areas in Stanislaus and Merced counties. It is anticipated that enforcement actions similar to those in the Salinas Valley and Tulare County will be initiated in early 2019 in the ESJWQC region.

The crux of these issues is excessive nitrate in groundwater aquifers used for drinking water by thousands of residences including populations residing in disadvantaged communities. The adoption by the State Water Board of the Human Right to Water in addition to studies by the University of California and others has led to the conclusion that irrigated agriculture is in large part responsible for the problem of high nitrate in groundwater aquifers.

Reporting of nitrogen fertilizer applications is the first step in understanding and addressing the issue of nitrate leaching from agricultural lands. The Coalition is providing information to members based on these reports that can indicate when growers apply more than the crop removes which could lead to leaching of nitrate. With additional outreach and education provided through the Coalition, the goal is to have growers improve their nitrogen use efficiency. Over time, the demonstration of improved efficiencies will help slow and even reverse the documented levels of nitrate in groundwater.

The General Order adopted last February includes a requirement to develop Groundwater Protection Targets (GPT), an immensely technical undertaking whose approach is still being developed. The expectation is that these GPTs will provide growers with meaningful goals for reducing leaching that will eliminate degradation and lead to improved groundwater quality.

In the meantime, the Water Boards and public are using all means to ensure that those who are using wells with high concentrations of nitrate are provided safe drinking water until the problem is solved. How long that will take and how much it will cost is uncertain.

What is certain is that the ESJWQC Board, staff, its consultants and legal team will be doing all it can to represent the interests of growers.

Parry Klassen
Executive Director
209-846-6112 or
director@esjcoalition.org

Coalition Overview

Membership

As of January 2019:

- 3,341 landowner/operators
- 701,009 irrigated acres

Boundaries

The Coalition area includes Madera County and portions of Stanislaus, Merced, Tuolumne, Mariposa, and Calaveras counties. The Coalition area is bordered by the crest of the Sierra Nevada on the east, the San Joaquin River on the west and south, and the Stanislaus River on the north. There are four major tributaries in the watershed: Chowchilla River, Merced River, Tuolumne River and Stanislaus River.

Structure

The Central Valley Regional Water Quality Control Board initiated the Irrigated Lands Regulatory Program (ILRP) in 2003 with the adoption of a Conditional Waiver of Waste Discharge Requirements (WDR) for discharges from Irrigated Lands. The Coalition was formed in 2003 to assist growers in the East San Joaquin watershed area with the compliance requirements of the WDR. A volunteer Board of Directors oversees this organization, which is structured as a public benefit, non-profit entity to perform tasks required under the ILRP. In November 2005, the Coalition was granted non-profit status as a 501 c5 organization by the Internal Revenue Service. The Coalition is managed by a Board of Directors and administered by an Executive Director. Water quality monitoring, membership management, and outreach are performed by entities contracted to ESJWQC.

Member Outreach and Best Management Practices

The Coalition is continuing its efforts to work with landowners in watersheds where surface water monitoring indicates problems. Central to this effort will be promoting Best Management Practices (BMPs) with the best potential for solving the problem. When a problem is identified, the Coalition will:

- Contact landowners upstream of the monitoring site and inform them of the constituent(s) identified.

- Distribute BMP information through mailings, individual visits, and local grower and crop advisor meetings.
- Give educational presentations on monitoring results and potential BMPs at commodity and farm group meetings in the Coalition region.

Monitoring Program Objectives

- Characterize discharge from irrigated agriculture in the Coalition region
- Identify locations where water quality objectives are not being met (exceedances)
- Identify potential source(s) of the exceedances
- Promote to landowners the implementation of management practices to eliminate water quality problems

Fees Assessed by the State Water Resources Control Board

In 2018, the ESJWQC paid the 87 cents per acre fee for Coalition members to the State Water Resources Control Board to cover the cost of implementing the Irrigated Lands Regulatory Program, primarily for Regional Board staff. All members of agricultural coalitions throughout the state pay this annual fee. The per acre fee is included as part of Coalition membership dues.

ESJWQC Goals

- To operate an efficient, economical program that enables members to comply with the Irrigated Lands Regulatory Program
- File required reports with the Central Valley Regional Water Quality Control Board to maintain ILRP coverage for Coalition members.
- Implement an economical and scientifically valid water monitoring program for rivers and agricultural drains (as required by the ILRP).
- Spread costs equitably among owners/operators who are Coalition members.
- Communicate to landowners where water monitoring indicates problems and work to solve those issues.



Financial Overview

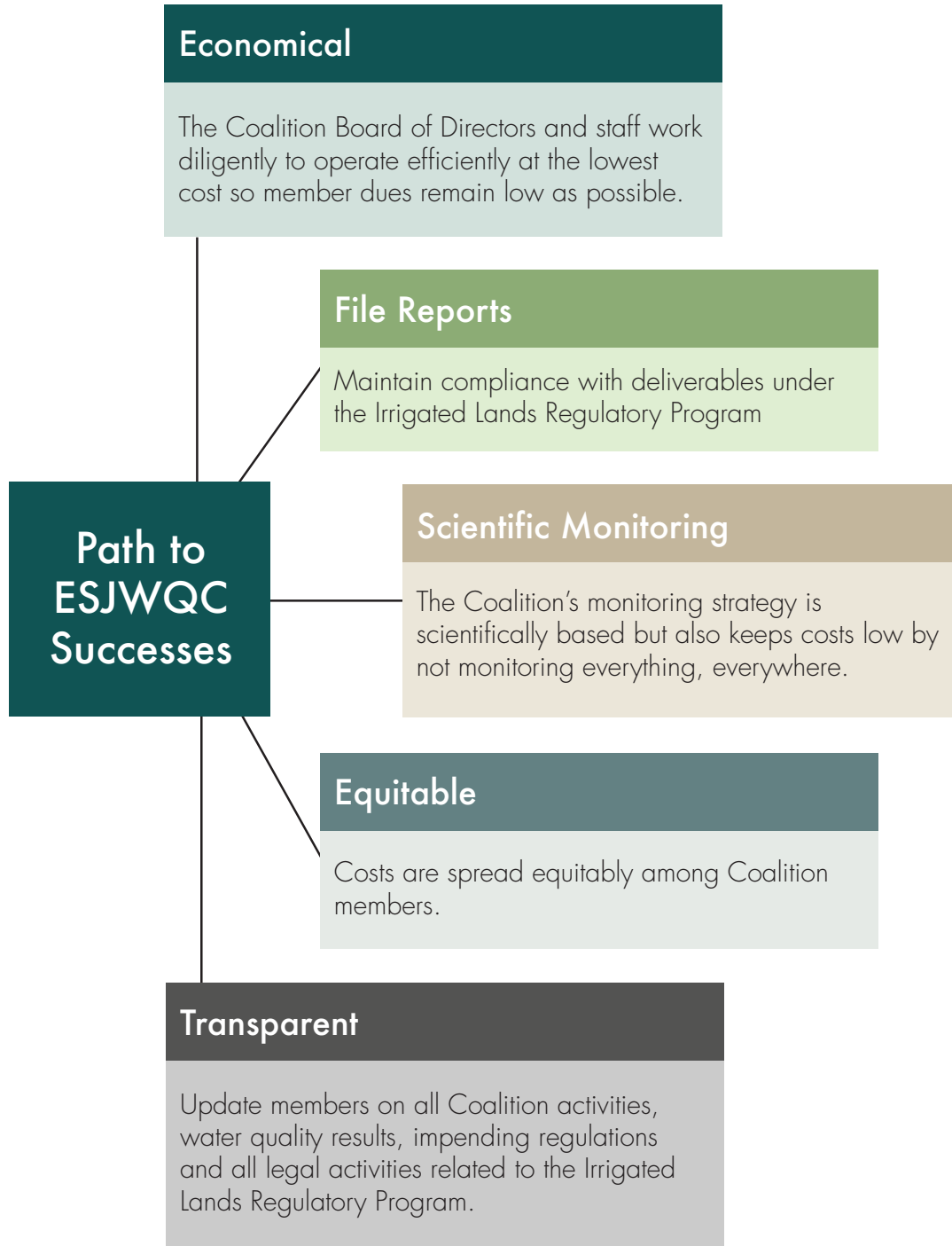
Reported below is a financial overview comparing the ESJWQC 2018 budget with the actual 2018 expenditures. The 2018 net income was higher than projected. As indicated in the footnote “*Balance Available,” there was approximately \$2.1 million in ESJWQC banking accounts. A complete financial statement of 2018 expenditures is available upon request.

ESJWQC has contracted the services of Atherton & Associates, LLP, located in Modesto, to perform an audit of our financial statement for calendar year 2017. The CPA firm reported that the ESJWQC financial statements were “fairly presented in conformity with U.S. general accepted accounting principles.” The full text of the audit report is available upon request.

	Actual* 2018 \$K, (Thousands)	Budget 2018 \$K, (Thousands)	Description
INCOME			
Total Income	3,083	3,016	Membership dues plus interest on bank accounts in 2018
EXPENSES			
Organizational	889	924	Executive director, legal, accounting, State Ag Waiver fees, meetings, and miscellaneous business costs.
Program	2,181	2,609	Program manager, site monitoring/special studies, quality control/assurance, membership management and correspondence, BMP assessment, and contractors doing work for the Coalition
Travel & Meeting	13	15	Expenses for executive director
Total Expenses	3,083	3,548	
Net Income	\$0	(\$532)	Difference between Total Income and Total Expenses.

* At the end of December balances in the checking and savings accounts totaled \$2,097 K.

How the Coalition Works for You



ESJWQC Web Portal: Your Online Membership Management Tool

Web Address: www.esjmemberlogin.com

Get Started with 3 Easy Steps:

- Step 1.** Request a passcode by emailing ESJWQC staff at contactesj@esjcoalition.org or call (209) 846-6112.
- Step 2.** Navigate to website at address above
- Step 3.** Login using your email address and passcode. Personalize your passcode after logging in.

PORTAL FEATURES

- Convenient 24/7 access to your membership information including enrolled parcels, invoice, and upcoming events.
- Update mailing preferences (paper or email)
- Assign Secondary Contacts to Parcels
- Complete and instantly submit your:
 - Nitrogen Management Plan (NMP) Summary Report to the Coalition
 - Complete past due reports

Questions?

Call (209) 846-6112
or email contactesj@esjcoalition.org



Member Portal Opening Page

Portal Overview

1. Update your contact information associated with your membership.
2. View the documents you are required to complete for the year. After reports are submitted, the status will update from "Outstanding" to "Completed."
3. View a map of your enrolled parcels.
4. View upcoming Coalition events: meetings, trainings and workshops.
5. Complete the NMP Summary Report online.
6. Complete the Farm Evaluation online.
7. View all past Farm Evaluations and NMP Summary Reports submitted to the Coalition.

2018 Water Quality Improvement Highlight

Duck Slough (Merced County)

Site Description

Duck Slough is sampled at Gurr Road in southern Merced County. The site has been monitored by the Coalition continuously since 2004. Duck Slough originates in the Sierra Nevada foothills and flows west, eventually draining into the San Joaquin River via Deep Slough and Bear Creek. Duck Slough carries natural flows plus irrigation runoff from field crops, deciduous nuts and pastureland. Merced Irrigation District periodically diverts water deliveries through the slough to downstream users.

Management Plans

The most recent exceedances of pesticide standards were in 2015 for chlorpyrifos and malathion. Levels were so high they also caused toxicity to invertebrates, the indicator species used for these insecticides. These exceedances trigger development of a management plan for both pesticides. When a management plan is initiated, the Coalition conducts additional outreach to members in the watershed in an effort to prevent future exceedances. Management plans are considered completed by the Regional Water Board after three consecutive years of monitoring with no exceedances.

Outreach and Education

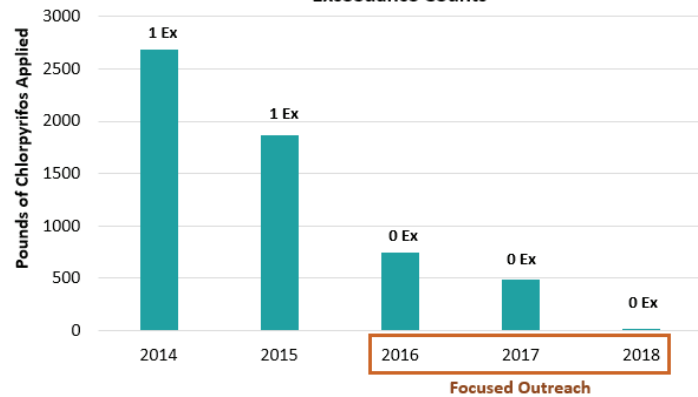
From 2016 through 2018, Coalition representatives met individually with eight members associated with exceedances that occurred in 2015. After this "Focused Outreach" was initiated in 2016, there were no more exceedances for chlorpyrifos, malathion and toxicity. As the chart at right indicates, a contributing factor was growers' reduction in use of insecticides containing the active ingredients chlorpyrifos and malathion.

Minimizing potential spray drift and irrigation drainage also contributed to the elimination of exceedances.

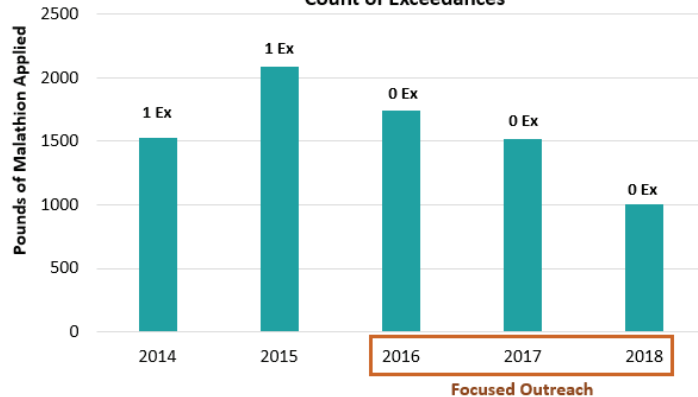
Management Plan Completion

As a result of three years monitoring with no exceedances and toxicity, the Coalition, in 2018, petitioned the Regional Water Board for the completion of all three management plans. Once the management plans are approved for completion, the Coalition will end management plan monitoring scheduled for 2019.

Duck Slough Watershed: Pounds of Chlorpyrifos Applied and Exceedance Counts



Duck Slough Subwatershed: Pounds of Malathion Applied and Count of Exceedances



2019 Member Reporting Requirements and Due Dates

The Coalition’s primary goal is assisting members with regulatory requirements to stay in compliance with the Irrigated Lands Regulatory Program. These regulations are called Waste Discharge Requirements (WDR) by the Central Valley Regional Water Quality Control Board. Members remain in good standing by paying annual dues, completing all surveys and reports required by the WDR (Table 1), attending an annual grower meeting and participating in focused outreach where necessary. In February 2018, the WDR was revised by the State Water Board. Key changes were made to the reports and deadlines for the Farm Evaluation, Nitrogen Management Plan Worksheet and Nitrogen Management Plan Summary Report. See the following page for a summary of changes to each report.

Annual Grower Meetings

Each winter and fall the ESJWQC holds member meetings in Merced, Madera and Modesto to inform members on surface water monitoring results from the previous water year, management practices, member requirements and groundwater quality information. Included in these meetings is information on nitrogen

application practices and the potential impact of nitrates on groundwater. The Coalition also provides attendees with crop-specific handouts about recommended crop fertilization guidelines for the top six crops grown in the Coalition region. Any member who has a field or management unit that is a “statistical outlier” for nitrogen applications is required to attend one of these meetings or view a video recording of the meeting. Meeting videos are usually posted by March 30. All members are required to attend one Annual Grower meeting each year.

Sediment and Erosion Control Plans (SECP)

Members with parcels located within 200 yards of a creek, slough, or river (waterway) have the potential to discharge sediment into waterways. The Coalition uses a model to identify parcels with the potential to discharge sediment at greater than 5 tons/acre/year during rainfall runoff events. All members who need to maintain a certified SECP on farm have been contacted by the Coalition and should already have their plans certified. If you need additional information about certifying an SECP, please contact the Coalition.

Member Reporting Due Dates

Table 1. Upcoming requirements for members in low and high vulnerability areas

Upcoming Due Date	Member Requirement	Low Vulnerability	High Vulnerability	Submitted To
		Reporting Frequency		
As Needed	Notice of Confirmation	Once		ESJWQC
Past Due	Sediment and Erosion Control Plan ¹	Members with parcels in proximity to tributaries must have SECPs certified		On Farm
3/1/2019	INMP Worksheet	Annually ²		On Farm
3/1/2019	NMP Summary Report 2018 Crop	Not Required	Annually	ESJWQC
12/31/2019	Domestic Well Monitoring	All Members with domestic well on enrolled parcels		GeoTracker by lab
NA	Farm Evaluation Plan (2020 Crop Year)	Every 5 years		ESJWQC

¹Certification required. ²Certification required for members located in High Vulnerability areas.

Changes to Member Reports in 2019

Farm Evaluations

Most members have been filling out a Farm Evaluation (FE) every year since 2013. These surveys were required to be submitted every March for members in high vulnerability groundwater areas. This requirement has changed and the FE now is required once every 5 years. It's worth noting that two questions previously on the FE were moved to the Irrigation and Nitrogen Management Plan Worksheet and Summary Report. Updates to grower surveys are highlighted on this page.

Irrigation and Nitrogen Management Plan Worksheet

An Irrigation and Nitrogen Management Plan (INMP) is a worksheet designed to assist growers in planning their crop irrigation and nitrogen applications in advance of the growing season. The INMP is kept on farm for reference and can be updated throughout the year, if needed. Growers with parcels in high vulnerability groundwater areas are required to have their INMP certified by a Certified Crop Advisor (CCA). An alternative is for the grower to attend a course that enables them to certify their own INMP. The course, developed by the California Department of Food and Agriculture (CDFA) and managed by the Coalition for Urban Rural Environmental Stewardship (CURES), schedules events throughout the year. Course dates are posted at: <https://www.curesworks.org/grower-training/>

INMP Summary Reports

An INMP Summary Report is submittal annually to the Coalition and contains information on irrigation and nitrogen practices, crop type, acres, pounds of nitrogen applied per acre and yield per acre. All the information on the INMP Summary Report is found on the INMP. The coalition analyzes and aggregates the INMP Summary Report information by crop and reports it to the Regional Water Board. In coming years, these data will assist in determining how much nitrogen may be leaching to groundwater by comparing nitrogen applied to nitrogen removed by crop. This information is also used to inform growers of their nitrogen use compared to

Farm Evaluation Updates

- Due **March 1, 2021**
- Removed Irrigation Practice Questions
- Removed Nitrogen Management Questions
- Added questions about domestic wells per parcel
- Completed once every five years.

INMP Worksheet Updates

- Completed and On Farm by **March 1, 2019**
- Added documentation of irrigation and nitrogen management practices
- Added Crop Evapotranspiration
- Anticipated crop irrigation
- Outlier status
- Primary and secondary harvest information
- Needs certification if located in High Vulnerability Area

INMP Summary Report Updates

- Due **March 1, 2020**
- Report nitrogen applied from irrigation water, synthetic fertilizers, and organic matter
- Report on irrigation and nitrogen management practices
- Report INMP Worksheet certification method
- Report that you were notified of Outlier status.

other growers of the same crop.

In 2019, members will submit the existing NMP Summary Report included in the Grower Packet mailed in November 2018. Beginning in March 1, 2020, growers will be asked to submit the updated INMP Summary Report that covers their 2019 crop nitrogen applications. This new INMP Summary Report will be sent to growers in Fall 2019.



Nitrogen Reporting, Outreach and Education

2018 Nitrogen Reporting Summary

In 2018, the Coalition received 96% of the Nitrogen Management Plan (NMP) Summary Reports back from members located in high vulnerability area. The Coalition completed a statistical analysis that compared member nitrogen Applied/Yield (A/Y) information to other members who produce the same crop. These data, in aggregated format, were included in an analysis submitted to the Central Valley Regional Water Board in compliance with the Irrigated Lands Regulatory Program.

Top 6 Crops in Coalition Area:

- Almonds
- Walnuts
- Grapes
- Pistachios
- Corn
- Tomatoes

Focused Outreach for Outliers

Beginning in 2019, members with outlier management units in two of the three reporting years (2016, 2017, 2018) that grow one of the top six crops in the Coalition area will be

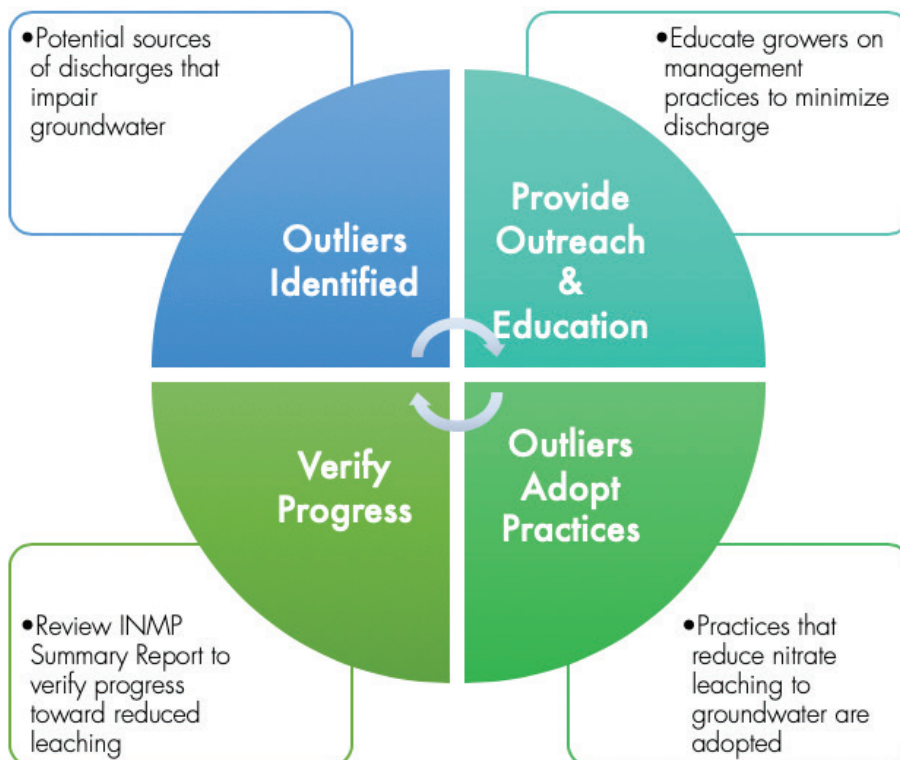
required to participate in groundwater Focused Outreach.

In general, the Focused Outreach will include information on management practices to minimize or eliminate nitrate leaching to groundwater. Members will be asked to complete a survey covering management practices implemented as a result of outreach and education. The Coalition will track improvements in members' A/R ratios as a result of outreach and the practices that helped to reduce potential leaching of nitrate to groundwater. The figure below illustrates this process.

Members who need the Focused Outreach can expect to be notified by March 2019.

Management Practice Implementation Report (New)

The revised WDR adopted in February 2018 added a new report called the Management Practice Implementation Report (MPIR). This report is intended to document the practices members implemented in an effort to address issues that trigger either a surface water or groundwater management plan. For the latter, the Coalition recently proposed to the Regional Water Board that only members with outlier management units (based on nitrogen applied and removed) complete an MPIR, instead of all Coalition members. This request is under review by the Regional Water Board.



Focused Outlier Outreach Approach

Determining Nitrogen Removed (R) With Crop Coefficients

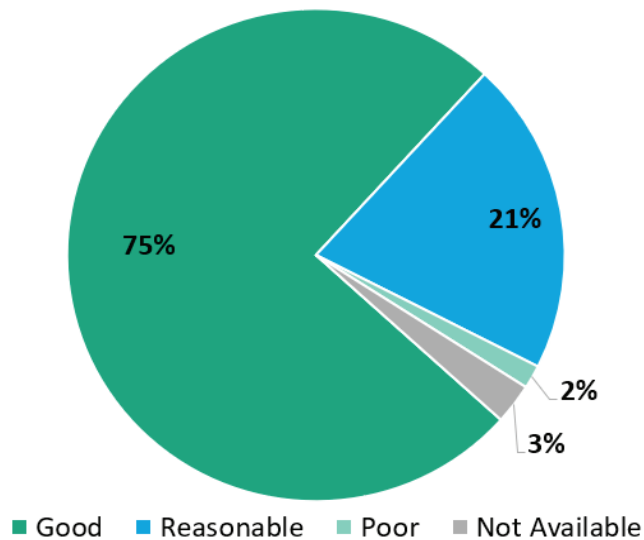
The Coalition utilizes crop-specific coefficients to convert crop yields to nitrogen removed values. In 2016, Dr. Daniel Geissler, UC Davis, prepared a report where he compiled and summarized all relevant literature on harvested nitrogen and/or the amount of protein (then converted to nitrogen) for many crops grown in the Central Valley. The Coalitions submitted to the Regional Water Board this summary of nitrogen removed estimates for all crops analyzed by Geissler.

The Coalition performed a separate analysis of Geissler’s report and ranked nitrogen removed values as Good, Reasonable, and Poor. Of the 79 crop coefficients compiled by Geissler, the Coalition ranked 13 of the values as good, 26 as reasonable, and 24 as poor. The figure at the bottom of this page shows the percentage of acreage reported from 2018 NMP Summary Reports that has good, reasonable, poor, or unavailable crop coefficients. Overall, 75% of the reported member acreage has crop coefficients that the Coalition ranks as “good” and can accurately indicate the nitrogen removed.

Good	Reasonable	Poor
Almonds	Grapes	Hay
Pistachios	Walnuts	Figs
Silage, Corn	Grapes, raisins	Cherries
Hay, Alfalfa	Peaches	Grains, Corn
Silage	Citrus	
Potatoes	Greens	
Tomatoes	Olives	
Grains		
Cotton		
Prunes		

By March 1, 2021, the new WDR mandates that the Coalition publish coefficients for crops that make up 95% of the Coalition acreage. By March 1, 2023, coefficients are needed for 99% of the crop acreage. Majority of crops grown in Coalition area with Good, Reasonable, and Poor crop coefficients

Percent of Coalition Acreage with Crop Coefficients



Member Nitrogen Use Evaluations

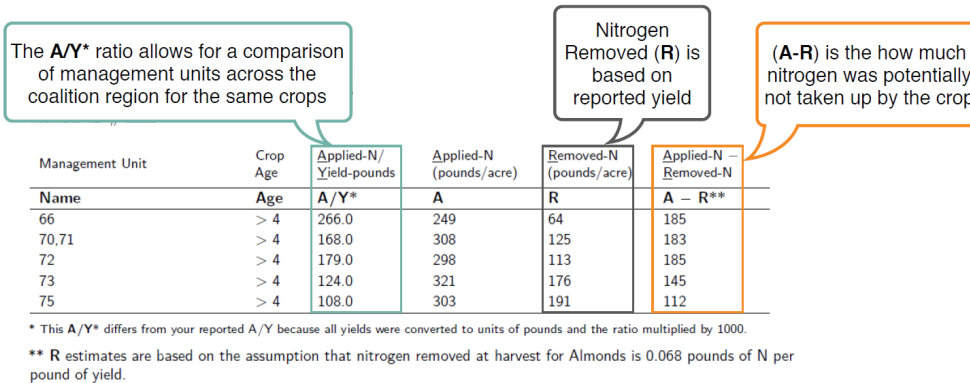
Growers who returned an NMP Summary Report in 2018 will be sent in February/March of 2019 a summary of their nitrogen use information plus an evaluation of management unit nitrogen use. Data reported on the amount of nitrogen fertilizer applied is compared to the recommended rates developed by the University of California (UC). The Regional Water Board requires that the Coalition indicate to members where nitrogen application rates to a field or management unit are above the average amount recommended by the UC. Fields that exceed those levels are considered a “statistical outlier.” Members are then notified about additional follow up actions required for “outlier” fields or management units.

Understanding Your Nitrogen Use Evaluation

What It All Means

Members who submit an NMP Summary Report will receive a Nitrogen Use Evaluation report prepared by Coalition staff and its technical consultants. This is a confidential report that provides an analysis of how much nitrogen your crop “uses” compared to how much nitrogen was applied to the field or management unit. The nitrogen “use” is determined using the crop

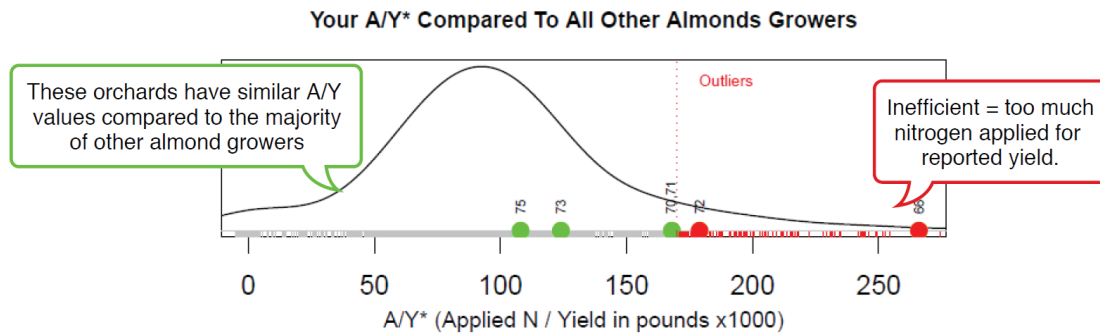
coefficients described in the previous page. The intention of the individual analysis is to enable members to make an informed decision when planning upcoming crop nitrogen applications. It also provides a comparison of your application rates to other growers of the same crop and where available, crop coefficients and University of California recommendations.



Understanding Bell Curves

A bell curve allows you to visually see the distribution of reported member data. The peak of the bell curve represents the most commonly reported value (mode).

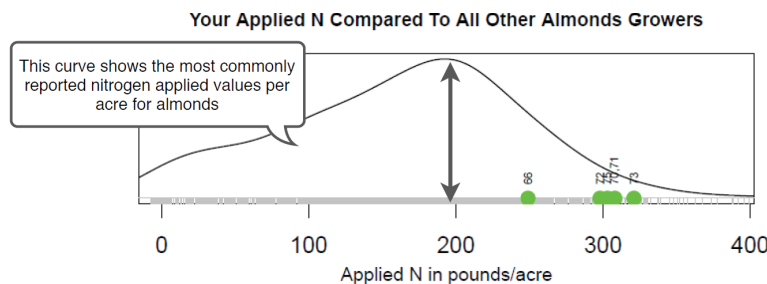
As the curve slopes away from the mode, fewer growers reported those values. In the curve below, the ends signify growers that are either very efficient or inefficient.



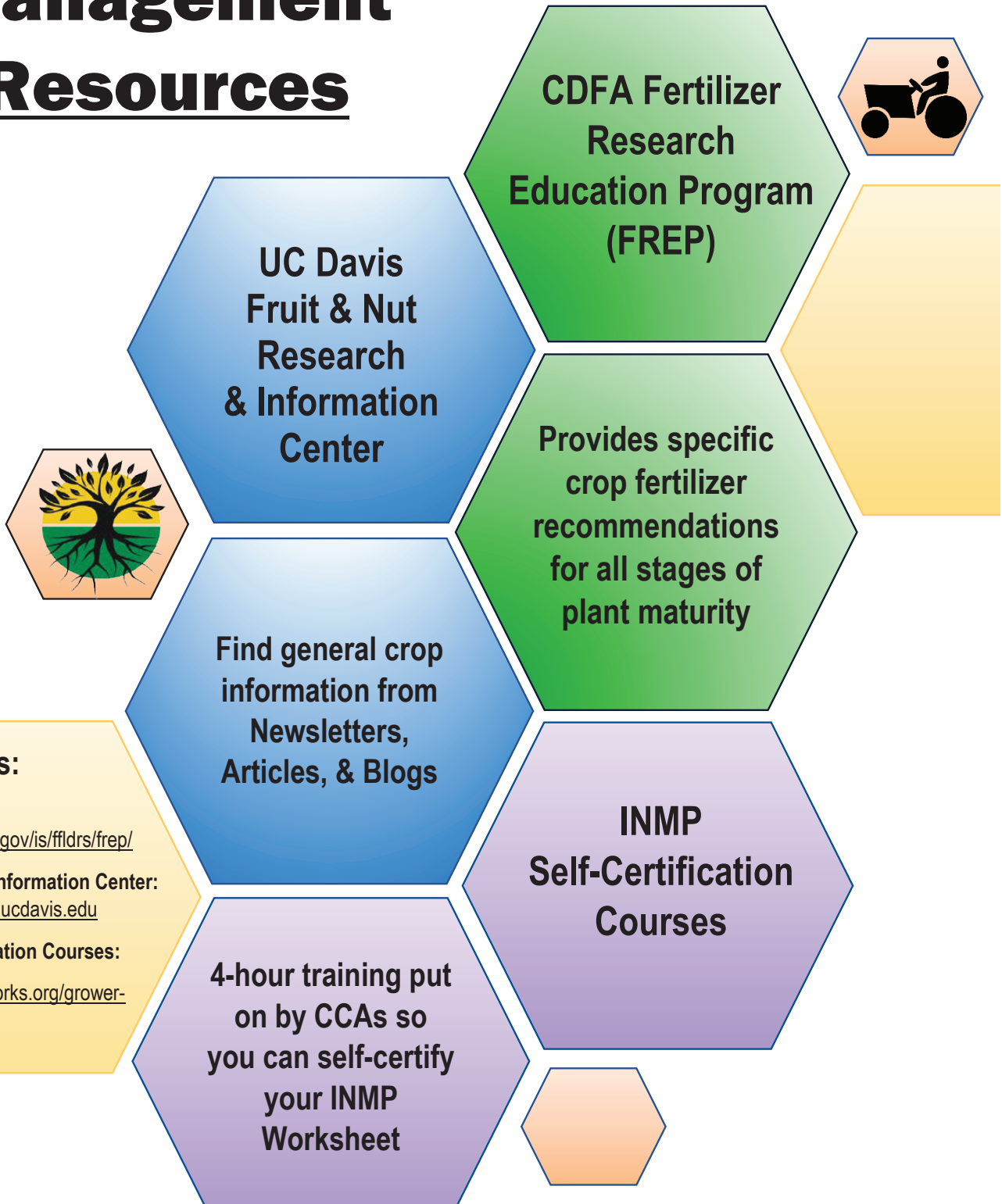
Reported Nitrogen Applications

This bell curve compares several fields or management units to the most commonly reported values of nitrogen applied per acre to almonds during the 2016 growing

season. Based on this curve, an average of about 200 pounds of nitrogen per acre is applied to almonds (as both applied nitrogen and nitrogen in irrigation water).



Farmer's Nutrient Management Resources



Groundwater Program

Characterizing Regional Groundwater Quality

The WDRs for all Central Valley Coalitions require each to develop the following groundwater quality related documents for each region:

- Groundwater Assessment Report (GAR)
- Management Practice Evaluation Program (MPEP)
- Groundwater Quality Management Plans (GQMP)
- Groundwater Quality Trend Monitoring Workplan (GQTM Workplan).

The Coalition submitted to the Regional Water Board a Groundwater Assessment Report (GAR) about the Coalition region in 2014. The GAR compiled the water quality results from thousands of wells tested in the region over the last 20+ years. The GAR also included information from soil surveys and other existing groundwater data in the region. All of the information was used to designate areas within the Coalition region that are at risk for leaching of nitrate to groundwater (high vulnerability) and areas with a low risk of nitrate leaching (low vulnerability). The vulnerability areas were based on three factors; soil type, depth to groundwater and existing concentration of nitrates in the groundwater. High vulnerability areas are generally found in permeable soils with shallow groundwater. Any location where the concentration of nitrate exceeds the drinking water standard is automatically a high vulnerability area. More than 70% of the ESJWQC region has been designated high vulnerability for groundwater.

Wellhead Practices to Protect Groundwater From Contamination

The Coalition is encouraging all members to have at least two of the practices listed to the right implemented for 2019. Unprotected wellheads can be a pathway for nitrate and other pollutants in groundwater.

Table of wellhead protection practices that prevent leaching of contaminates to groundwater.

Practice	Purpose
Air gap (for non-pressurized systems)	Air-gaps are non-mechanical means of backflow prevention. Air gaps must be twice the supply pipe diameter and never less than 1".
Backflow preventative/check valve	Check valves are designed to permit water to flow in one direction and are a requirement on all submersible pump installations.
Good "housekeeping" practices	Within 100 feet of a well, do not store any material that might contaminate your water supply (Examples: trash, fertilizers, pesticides, gasoline, paint, lawn-care products, automotive wastes).
Ground sloped away from wellhead	By having the ground sloped away from the wellhead, there is little chance of contamination.
Standing water avoided around wellhead	Soil profile can become saturated, speeding movement of contaminants through the soil.

Groundwater Quality Trend Monitoring

Groundwater Quality Trend Monitoring is intended to:

- 1) determine current water quality conditions relevant to irrigated agriculture and;
- 2) use the trend monitoring data to evaluate the regional effects of farm practices on groundwater over time.

Wells selected for trend monitoring draw water from the Upper Zone of the aquifer above the Corcoran Clay layer. Within the high vulnerability areas in the ESJWQC region, the depth to the bottom of the Upper Zone is between about 40 and 300 feet below ground surface.

In 2017, Luhdorff and Scalmanini (consulting firm hired by the Coalition) finalized a list of member wells to be included in the Groundwater Quality Trend Monitoring Network. Twelve member wells (Principal wells) met the three criteria listed in the WDR:

- 1) well is equipped with a functional pump,
- 2) well is at least 200 feet away from septic or animal confines, and
- 3) the owner of the well will allow the Coalition to obtain a Well Completion Report (WCR) from DWR.

In addition to member wells, the Coalition is using well monitoring data from 74 public supply wells (Complementary wells) throughout the region. The network of wells includes a combination of municipal drinking water wells, dedicated monitoring wells already in existence, and domestic or irrigation wells belonging to members. The high vulnerability groundwater area was divided into different priority levels as a way to represent different monitoring emphasis and objectives of the trend monitoring program.

2018 Trend Monitoring Results

The Coalition sampled the 12 member wells on October 30th. Results from the monitoring event are shown in the bar graph to the right. In general, the majority of samples were below the nitrate trigger limit (10 mg/L) except for three samples. The Coalition will provide the groundwater trend monitoring results to those members who are part of the network in early February. The

results will count toward the members' requirement to sample their domestic well.

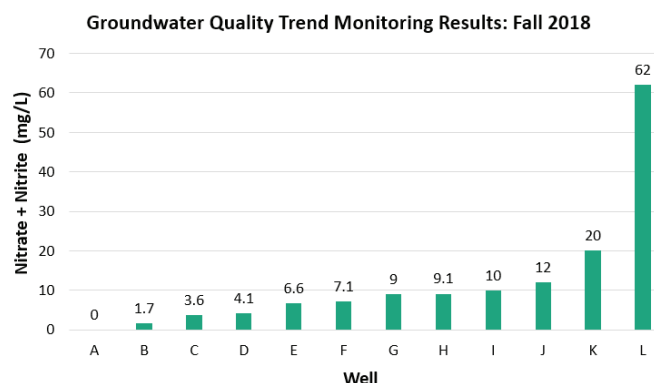
Areas in Need of Additional Wells

The Coalition's Trend Monitoring Network was determined by the Regional Water Board to be incomplete for some areas where a monitoring well wasn't selected. In 2018, many members stepped up to volunteer their shallow domestic wells for inclusion in the network. Due to the narrow criteria that the wells have to meet, about four wells will be added to the network in 2019. However, we still have "holes" in the network and need additional members to volunteer their wells. The specific areas where we need additional wells are shown in the maps on pages 17 through 19 and the general areas is listed below.

Area Number	General Area
1	Waterford
2	Stevinson
3	El Nido
4	Chowchilla
5	West Madera
6	Firebaugh

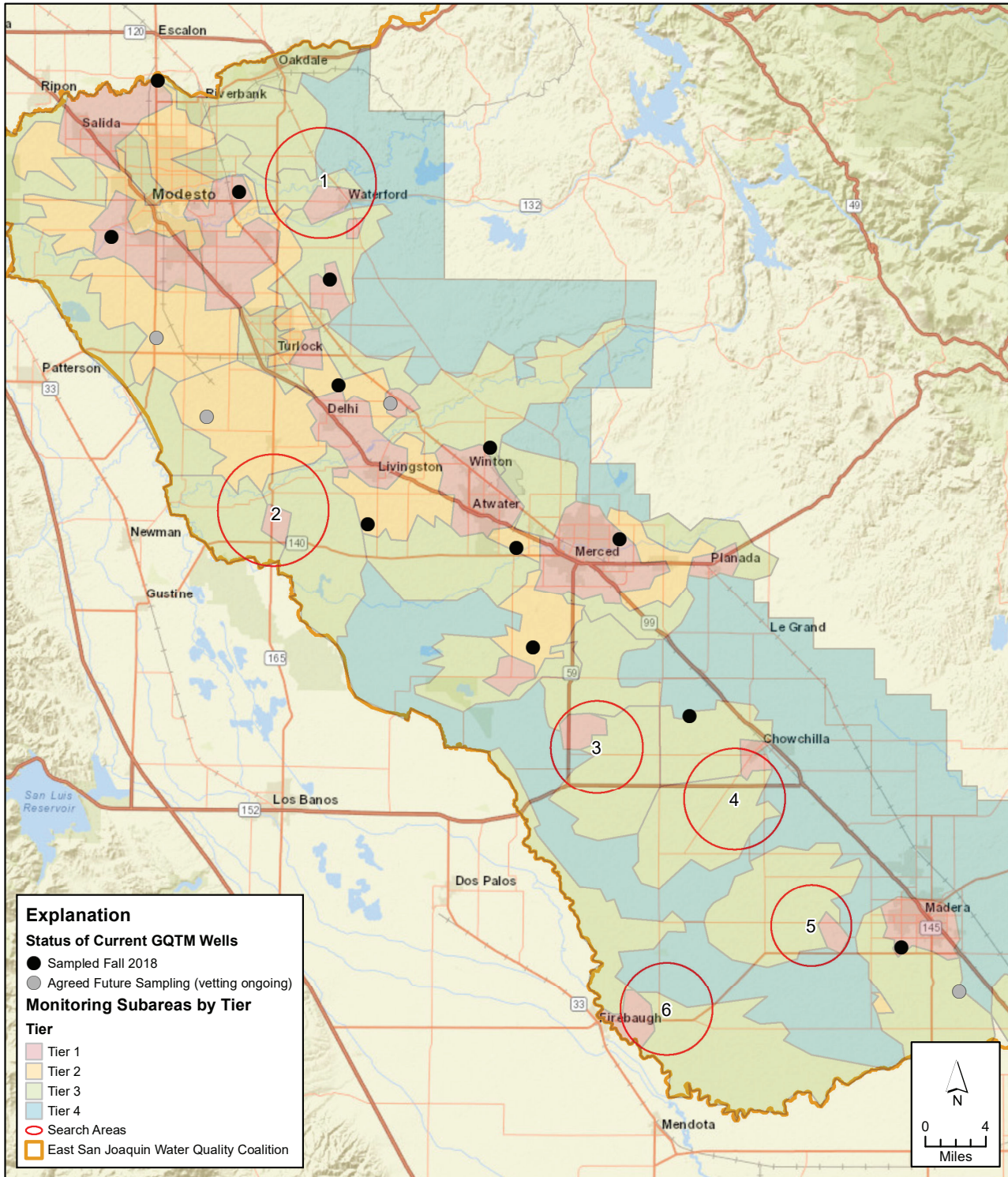
Perks of Being in the Trend Monitoring Network

- **Free Annual Monitoring**
- **Results automatically loaded to GeoTracker**
- **Notified of lab results after reviewed by staff**



Coalition Groundwater Trend Monitoring Wells

Red circles indicate areas where additional domestic wells are needed for trend monitoring.



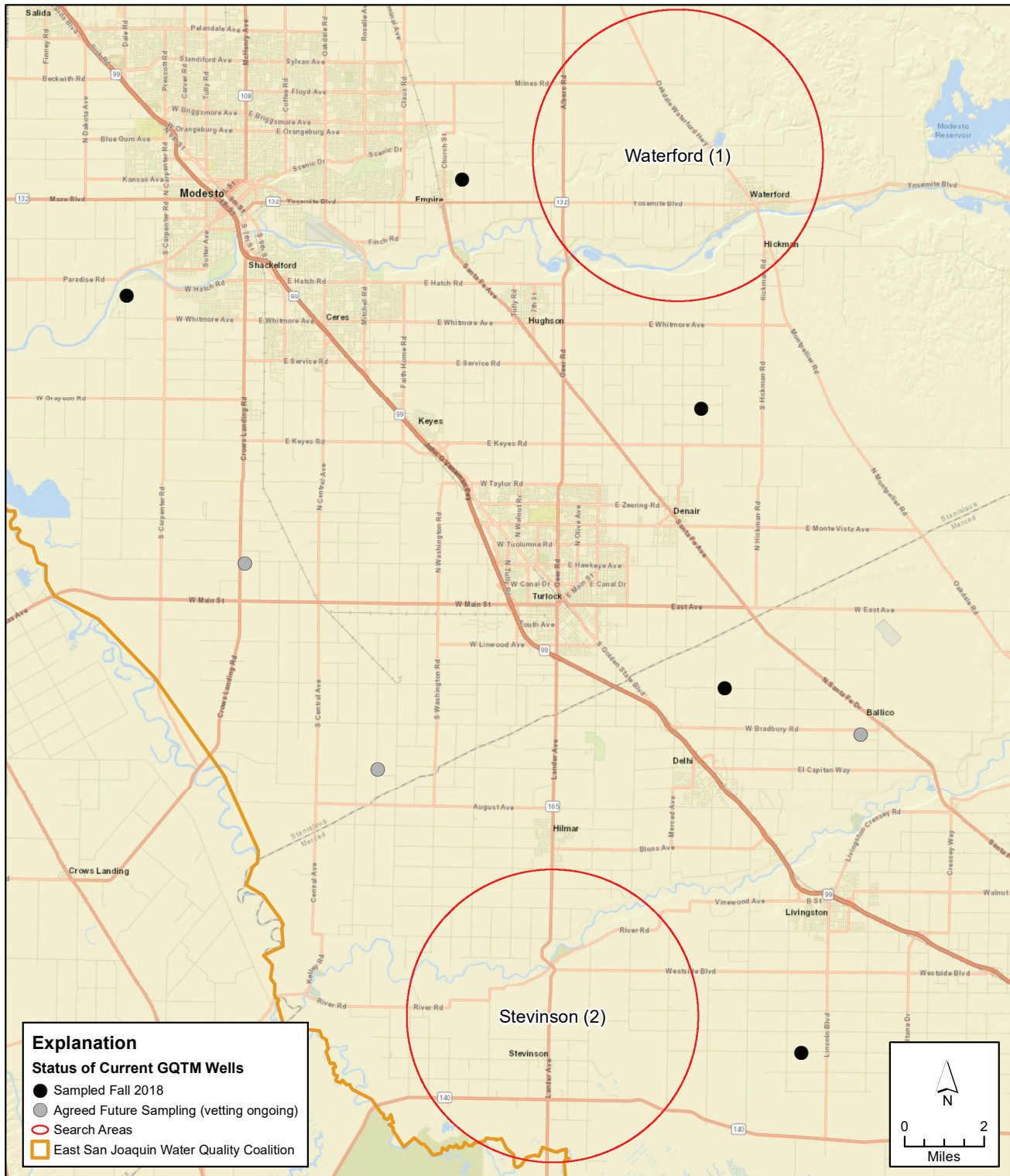
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East San Joaquin Water Quality Coalition
Current and Potential Principal Trend Monitoring Wells
Search Areas For Additional Wells

Northern Groundwater Trend Monitoring Area

Red circles indicate areas where additional domestic wells are needed for trend monitoring.



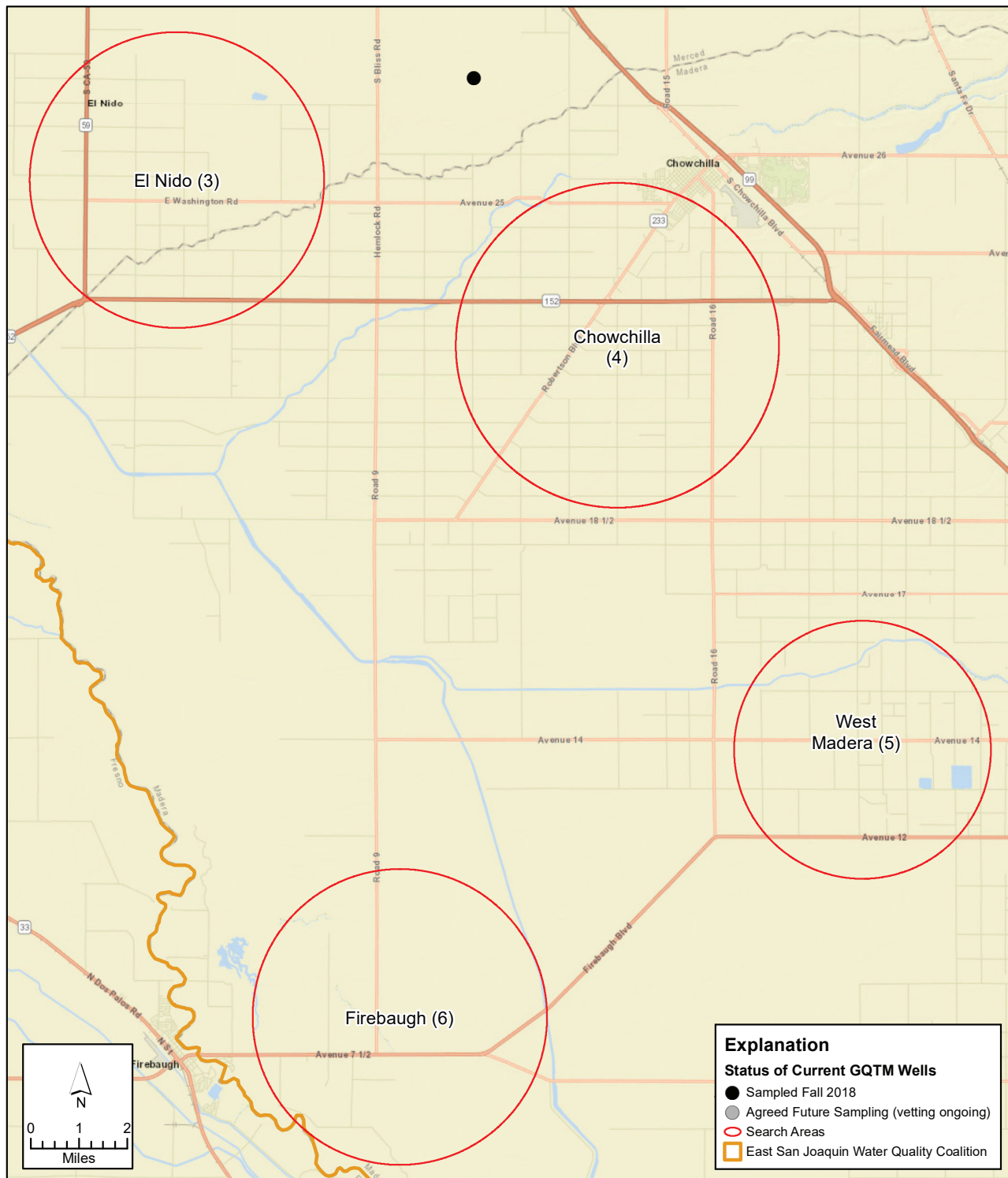
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**East San Joaquin Water Quality Coalition
Northern Region Search Areas For Additional Wells**

Southern Groundwater Trend Monitoring Wells

Red circles indicate areas where additional domestic wells are needed for trend monitoring.



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**East San Joaquin Water Quality Coalition
Southern Region Search Areas For Additional Wells**



New Water Quality Regulations Provide Options for Flexibility San Joaquin Valley and Delta Agriculture

Protecting Water Quality is Critical

Ensuring a safe, reliable drinking water supply is the highest priority for managing nitrates and salts throughout the Central Valley. Depending on local conditions, discharges from irrigated farmlands can contain salts, nitrates, sediments, pesticides, heavy metals, and pathogens. These pollutants can impact water quality via irrigation drainage or storm season runoff or by leaching into groundwater. At high enough concentrations, they can harm aquatic life in surface water or make groundwater unusable for drinking water or agricultural uses.

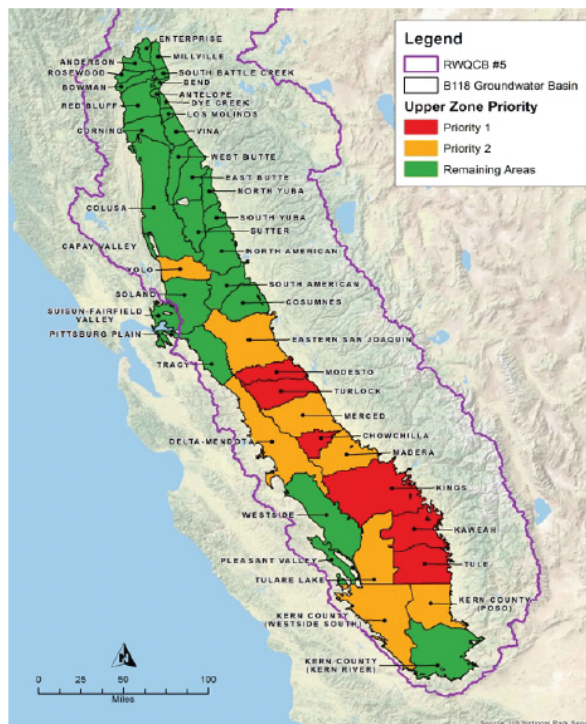
Ag Regulation: How it Works Now

The California Legislature in 1999 eliminated the waiver for agricultural waste discharges. This led to adoption in 2003 of the Irrigated Lands Regulatory Program (ILRP) by the Central Valley Water Board (Water Board). The ILRP was developed to control and prevent waste discharges coming from irrigated lands from polluting surface waters. In 2012, groundwater regulations were added. The ILRP seeks to protect surface and groundwater resources and drinking water supplies, while maintaining a healthy, sustainable irrigated agricultural economy. Farmers may join an ILRP Coalition that assists them in complying with Waste Discharge Requirements or they may choose to comply under individual Waste Discharge Requirements.

Current Regulations Limit Options

For the high-priority areas in the Central Valley with known groundwater contamination from nitrates (red areas on map), the existing ILRP regulatory options do not address the urgent need for safe drinking water. The ILRP does not offer an extensive enough range of options for a farmer to be able to meet established water quality standards for nitrates and salts.

Irrigated agriculture is faced with implementing expensive treatment requirements at the source of the pollution that result in limited benefit for drinking water users. Without the new regulatory options needed for the Water Board to allow local



Priority Areas for Managing Nitrates in Upper Groundwater Zone

flexibility for compliance, the prohibition of discharges would be required.

New Regulations Provide More Flexible Solutions to Comply

The importance of protecting surface and groundwater quality, whether for aquatic life, drinking water, or agricultural supply, has become a significant public policy issue. Because the Water Board has few options to best regulate the protection of water quality, additional tools are needed.

When implemented, starting in late 2018, the “toolbox” of new regulatory options in the CV-SALTS Salt and Nitrate Management Plan (SNMP) will offer greater local flexibility for compliance by all dischargers, while ensuring safe drinking water. The new options will first be implemented in areas identified as **high-priority** in the Kaweah, Turlock,

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Chowchilla, Tule, Modesto, and Kings sub-basins and basins (red areas on map).

Local Collaboration is Key

Under the new regulatory options, all dischargers, including agriculture, will be asked to collaborate locally to implement necessary solutions to meet **water quality** standards. Similarly, the 2014 Sustainable Groundwater Management Act (SGMA) provides a framework for **water quantity**, through sustainable, local groundwater management. While SGMA focuses on water quantity and the SNMP is focused on water quality, there will be close coordination between the two.

Key Benefits of New Regulatory Options

The “toolbox” of new regulatory options will be available to **all dischargers** whether they choose to comply under a traditional permit or participate in a local management zone.

Local Management Zone. The formation of local or regional management zones will save time, money, and resources. Farmers or landowners who decide to join a management zone can work collectively as part of a regulatory compliance unit. Members pool resources to implement water quality protection measures that ensure safe drinking water supplies. While working to provide safe drinking water, members may be authorized for nitrate and salt discharges and given more time to comply with current Waste Discharge Requirements.

Exceptions Policy. When prohibiting a discharge does more harm than good, and allowing the discharge to continue is determined to be better for the public good, an “Exception” can be authorized that provides farmers or landowners more time to implement a workable and effective regulatory solution that is site-specific to a local management zone.

Assimilative Capacity. Assimilative capacity is the ability of a natural body of water (e.g., lake, river, or groundwater aquifer) to receive discharged waste without harmful effects. Within a management zone

or a groundwater basin/sub-basin, using assimilative capacity along with localized management measures will be considered as a factor towards compliance.

Protection of Agricultural Beneficial Use. The current salinity requirements that protect agricultural beneficial water uses vary widely. With the new regulations, protecting the agricultural beneficial use of water will be tailored to reflect local and regional differences in water use by agriculture.

Coordinating New Regulations and ILRP. It is too soon to know how the CV-SALT SNMP-based regulations and the ILRP will be coordinated. With a common goal of controlling and protecting surface and ground waters from impairment by nitrates and salts, there will certainly be collaboration in meeting water quality objectives.

Compliance Cost. The costs associated with implementing the new regulatory options have yet to be determined. The approach of local management flexibility and collaborative action to address the highest priority needs first is expected to increase compliance efficiency. Growers are encouraged to be at the table now to help shape the future of the drinking water projects and alternative compliance projects in their area.

Get Involved, Shape Your Future

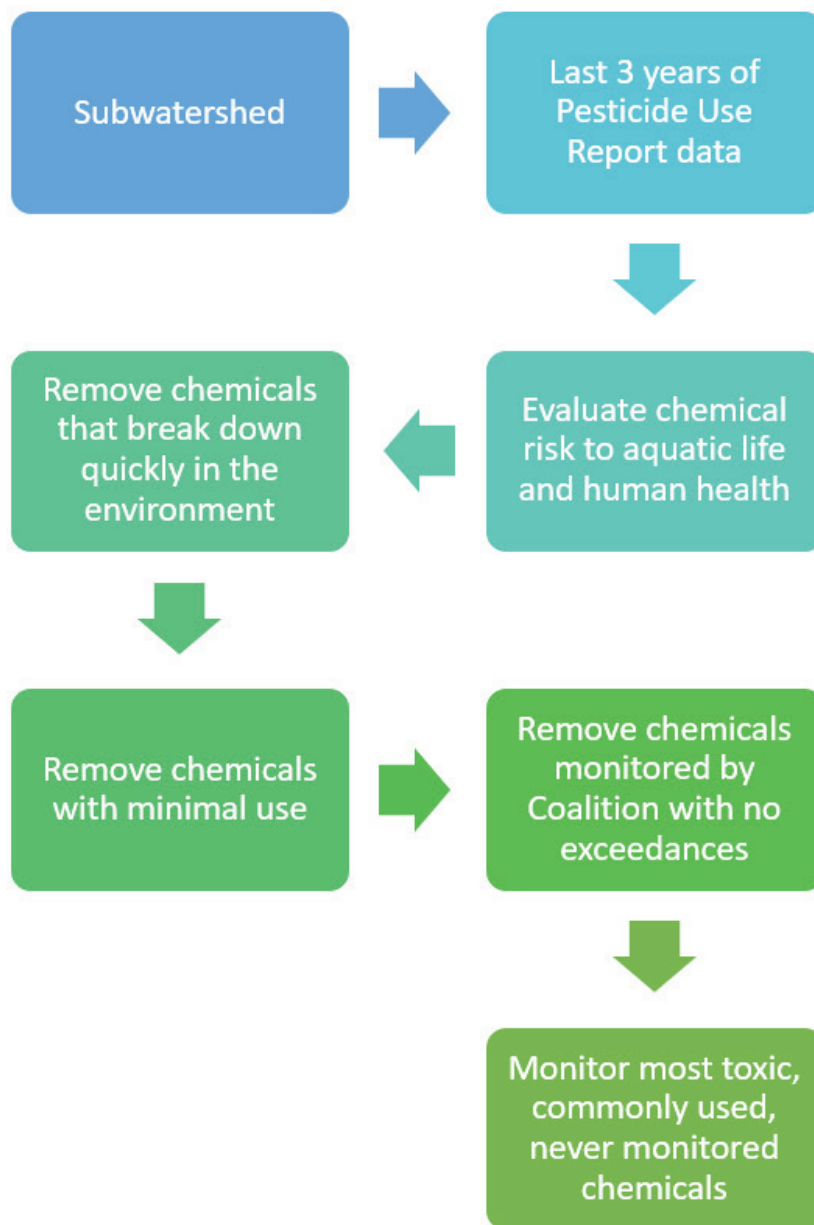
Without more flexible management options for nitrates and salts, regulators will likely continue to develop control measures that may make compliance more difficult, and even prohibit discharges. Irrigated agriculture’s voice is critical now to help shape the future of regulation. The “toolbox” of regulatory options agreed upon by diverse interests through CV-SALTS, and presented in the SNMP, will increase the potential for success and sustainability for farms, industries, and communities.

If you work in any aspect of irrigated agriculture, you are encouraged to participate and get involved now. Visit www.cvsalinity.org to learn more.

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How Pesticides are Selected for Monitoring in Area Waterways

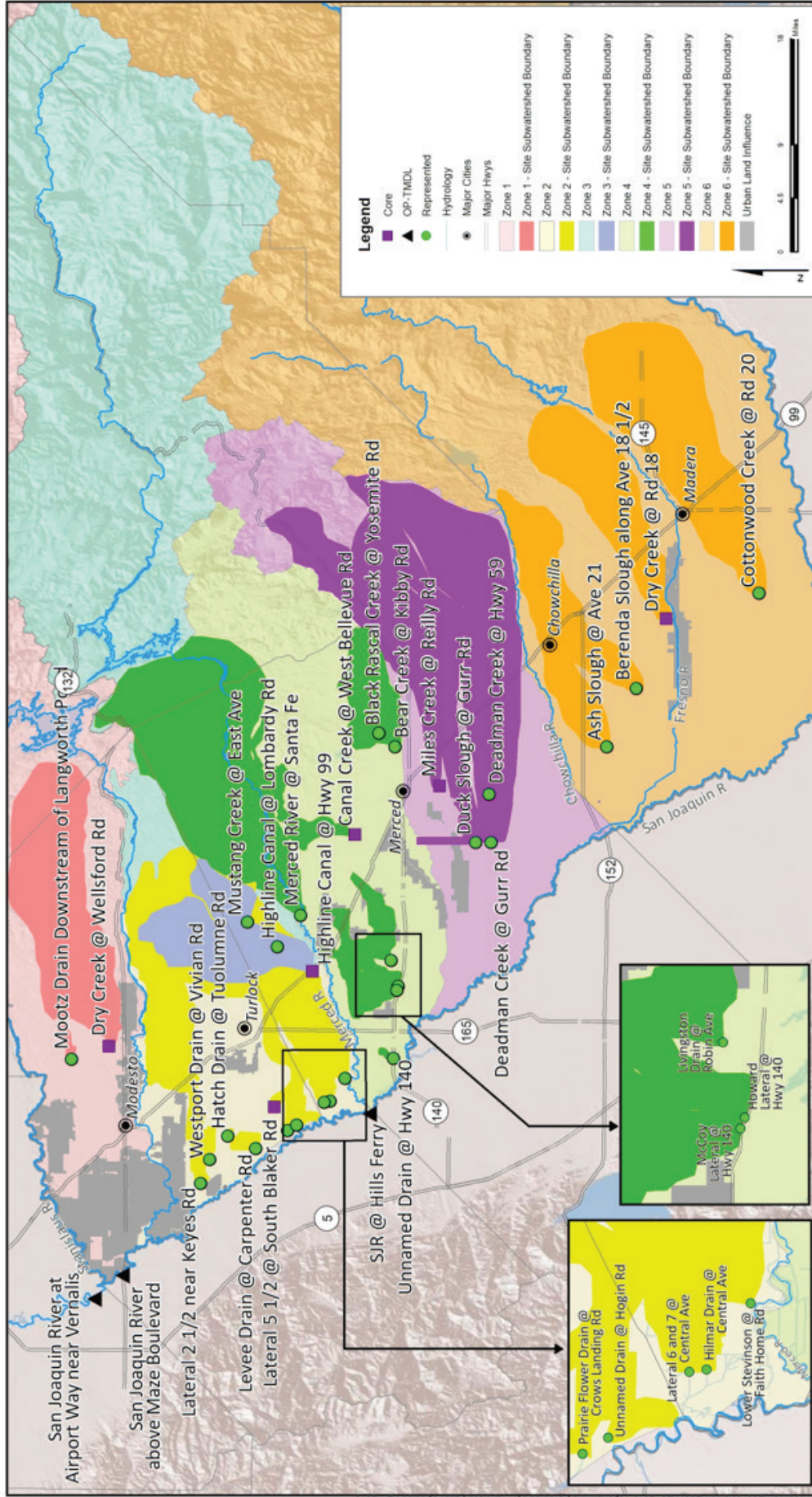
The 2018 WY (October 2017 – September 2018) was the first year that the Coalition implemented the Pesticide Evaluation Protocol (PEP). The PEP is a new method for determining which pesticides to monitor each month at each of the six Core surface water monitoring sites. The purpose of the PEP is to make surface water monitoring reflective of changes in pesticide use over time. The new strategy eliminates the repetitive monthly monitoring of the same constituents at all the Core sites that might not even be applied within the watersheds. For example, monitoring for the herbicide diuron used to occur at each of the six core sites, twelve months a year (72 samples). After the switch to PEP in the 2018 Water Year, only four samples were required to be collected. Annually, the Coalition evaluates each of the six Core sites and runs through the steps in the PEP to come up with an updated list of pesticides to monitor for the upcoming water year. The Coalition submits the next water year monitoring schedule annually on August 1. The flow chart to the right provides an overview of how pesticides are selected for monitoring based on the PEP.



2018 Water Year Monitoring Results

During the 2018 WY, the Coalition monitored for the class of pyrethroid and neotinicioid insecticides in the water column at all six Core sites. Noenicotinoids were not detected in any of the samples. Of the seven pyrethroids monitored, five were not detected and two were detected. Bifenthrin was the most commonly detected pyrethroid. There are currently no water quality trigger limits designated for pyrethroids, so no exceedances or management plans were initiated.

Surface Water Monitoring Sites Map



ESJWQC

ESJWQC 2018 WY Monitoring Sites Zone Boundaries



Coordinate System: NAD 1983 StatePlane California III FIPS 4023 Feet
 Units: Foot US
 Source: Lane County, Shasta River, Copyright © 2014 Esri
 Hydrology: 840 Hydrology, 1:250,000 scale, 100-foot map grid
 Land Use: "CAGAR", "T1", "COMBUST",
 Rights: See www.esri.com/go/gis/arcgis/arcgisserver



Coalition Monitoring Sites

X" indicates sampling occurred during the years specified (October 2014 – September 2018)

Zone	Site Type	Site Name	County	2014 WY	2015 WY	2016 WY	2017 WY	2018 WY
1	Core	Dry Creek @ Church St	Stanislaus	X	X	X	X	X
1	Represented	Mootz Drain Downstream of Langworth Pond	Stanislaus	X	X	X	X	X
2	Core	Prairie Flower Drain @ Crows Landing Rd	Stanislaus	X	X	X	X	X
2	Represented	Hatch Drain @ Tuolumne Rd	Stanislaus	X	X	X	X	X
2	Represented	Hilmar Drain @ Central Ave	Merced	X	X	X	X	X
2	Represented	Lateral 2 1/2 near Keyes Rd	Stanislaus	X	X	X	X	X
2	Represented	Lateral 5 1/2 @ South Blaker Rd	Stanislaus	X	X	X	X	X
2	Represented	Lateral 6 and 7 @ Central Ave	Merced	X	X	X	X	X
2	Represented	Levee Drain @ Carpenter Rd	Stanislaus	X	X	X	X	X
2	Represented	Lower Stevinson @ Faith Home Rd	Merced	X	X	X	X	X
2	Represented	Unnamed Drain @ Hogin Rd	Stanislaus	X	X	X	X	X
2	Represented	Westport Drain @ Vivian Rd	Stanislaus	X	X	X	X	X
3	Core	Highline Canal @ Hwy 99	Merced	X	X	X	X	X
3	Represented	Highline Canal @ Lombardy Rd	Merced	X	X			
3	Represented	Mustang Creek @ East Ave	Merced	X	X	X	X	X
4	Core	Merced River @ Oakdale Rd	Merced	X	X	X	X	X
4	Represented	Bear Creek @ Kibby Rd	Merced	X				
4	Represented	Black Rascal Creek @ Yosemite Rd	Merced	X	X	X	X	X
4	Represented	Canal Creek @ West Bellevue Rd	Merced	X	X	X	X	X
4	Represented	Howard Lateral @ Hwy 140	Merced	X	X	X	X	X
4	Represented	Livingston Drain @ Robin Ave	Merced	X	X	X	X	X
4	Represented	McCoy Lateral @ Hwy 140	Merced					X
4	Represented	Unnamed Drain @ Hwy 140	Merced	X	X	X	X	
5	Core	Duck Slough @ Gurr Rd	Merced	X	X	X	X	X
5	Represented	Deadman Creek @ Gurr Rd	Merced	X	X	X	X	X
5	Represented	Deadman Creek @ Hwy 59	Merced	X	X	X	X	X
5	Represented	Miles Creek @ Reilly Rd	Merced	X	X	X	X	X
6	Core	Cottonwood Creek @ Rd 20	Madera	X	X	X	X	X
6	Represented	Ash Slough @ Ave 21	Madera	X	X	X	X	X
6	Represented	Berenda Slough along Ave 18 1/2	Madera	X	X	X	X	X
6	Represented	Dry Creek @ Rd 18	Madera	X	X	X	X	X

WY – Water Year (October through September)

Exceedances of Water Quality Trigger Limits within the ESJWQC from October 2017 through September 2018.

Monitoring Location	Constituent	DO+	pH	SC	E. coli	Ammonia	Nitrate + Nitrite	Copper	Chlorpyrifos	Malathion	Water Flea	Fathead Minnow	Algae	Discharge Cubic Feet Per Second
	Water Quality Goal Sample Date	5 or 7 mg/L	<6.5 or >8.5	>700 µmhos/cm	235 MPN/ 100 ml	1.5 mg/L (variable)	10 mg/L	µg/L (variable)	0.015µg/L	>0 µg/L	Toxicity	Toxicity	Toxicity	
Ash Slough @ Ave 21	1/10/18													DRY
	3/5/18													DRY
	4/9/18													DRY
Berenda Slough along Ave 18 1/2	1/10/18													DRY
	2/13/18													DRY
	3/5/18													DRY
Black Rascal Creek @ Yosemite Rd	4/9/18													DRY
	2/13/18													DRY
	3/5/18	5.76						4.6 (2.65)						1.75
Canal Creek @ West Bellevue Rd	4/9/18	6.16												5.95
	12/5/18													5.16
	10/10/17													5.12
Cottonwood Creek @ Rd 20	11/7/17													5.87
	12/5/17													DRY
	1/10/18													DRY
	2/13/18													DRY
	3/5/18													DRY
	3/20/18													DRY
Deadman Creek (Dutchman) @ Gurr Rd	4/9/18	4.49			261.3									5.97
	6/12/18								0.025	0.03				NM
	7/10/18													2.32
	8/14/18							4.8 (4.61)						5.42
Deadman Creek @ Hwy 59	9/11/18													DRY
	11/7/17													DRY
	12/5/17													DRY
Deadman Creek @ Gurr Rd	1/10/18													DRY
	2/13/18													DRY
	4/9/18	6.39												51.83
Deadman Creek @ Hwy 59	9/11/18	5.34												NM
	1/10/18													DRY
	3/5/18													1.91

Exceedances of Water Quality Trigger Limits within the ESJWQC from October 2017 through September 2018.

Monitoring Location	Constituent	DO+	pH	SC	E. coli	Ammonia	Nitrate + Nitrite	Copper	Chlorpyrifos	Malathion	Water Flea	Fathead Minnow	Algae	Discharge
	Water Quality Goal Sample Date	5 or 7 mg/L	<6.5 or >8.5	>700 µmhos/cm	235 MPN/100 ml	1.5 mg/L (variable)	10 mg/L	µg/L (variable)	0.015µg/L	>0 µg/L	Toxicity	Toxicity	Toxicity	Cubic Feet Per Second
Hatch Drain @ Tuolumne Rd	1/10/18	0.24		1660										0
	3/20/18	0.38		1551										0
	5/8/18	1.08		1193										0
	7/10/18	0.32		1438										NM
	9/11/18	0.94		1257										0
Highline Canal @ Hwy 99	10/10/17										Toxic			52.33
	11/7/17													0.49
	12/5/17													Dry
	1/10/18													Dry
	2/13/18													Dry
	3/5/18													NM
	3/20/18													NM
	4/9/18													109.57
	5/8/18				290.9									15.79
	6/12/18	6.34	8.7											NM
Hilmar Drain @ Central Ave	7/10/18													75.93
	8/14/18													103.70
	9/11/18													48.79
	4/9/18	2.77		790										NM
	7/10/18	6.9		926										NM
Howard Lateral @ Hwy 140	9/11/18	6.48		1034									Toxic	NM
	10/10/17													17.51
	1/10/18							5 (2.26)						0.81
	2/13/18							3.6 (2.65)						Dry
Lateral 2 1/2 near Keyes Rd	4/9/18													14.9
	5/8/18													NM
	6/12/18													NM
	7/10/18													NM
	8/14/18		8.74											NM
Lateral 5 1/2 @ South Blaker Rd	10/10/17			1246										NM
	12/5/17													Dry
	1/10/18			1174									Toxic	NM
	2/13/18													Dry
	3/5/18			822										NM

Exceedances of Water Quality Trigger Limits within the ESJWQC from October 2017 through September 2018.

Monitoring Location	Constituent	DO+	pH	SC	E. coli	Ammonia	Nitrate + Nitrite	Copper	Chlorpyrifos	Malathion	Water Flea	Fathead Minnow	Algae	Discharge
	Water Quality Goal Sample Date	5 or 7 mg/L	<6.5 or >8.5	>700 µmhos/cm	235 MPN/100 ml	1.5 mg/L (variable)	10 mg/L	µg/L (variable)	0.015µg/L	>0 µg/L	Toxicity	Toxicity	Toxicity	Feet Per Second
Lateral 6 and 7 @ Central Ave	4/9/18													NM
	5/8/18													NM
	6/12/18													NM
	8/14/18													NM
	9/11/18												Toxic	NM
	1/10/18													NM
	3/5/18													NM
	4/9/18													NM
	5/8/18													NM
	6/12/18			1179										
Levee Drain @ Carpenter Rd	7/10/18		8.52											0
	8/14/18													NM
	12/5/17		8.82	1943										0
	2/13/18		8.71	2013										0
	6/12/18	0.68		1956										NM
Livingston Drain @ Robin Ave	12/5/17													Dry
	1/10/18							4.9 (2.26)						0.997
	2/13/18													Dry
	3/5/18													Dry
	10/10/17													0
Lower Stevinson @ Faith Home Rd	1/10/18			1043										1.10
	4/9/18													13.86
	5/8/18													50.66
	6/12/18													13.50
	7/10/18													0
	8/14/18													27.12
	9/11/18													2.25
McCoy Lateral @ Hwy 140	11/7/17													Dry
	5/8/18													0
	10/10/17								0.019					733
	11/7/17													230
	12/5/17													138
Merced River @ Oakdale Rd	1/10/18				307.6									208
	2/13/18													141

Exceedances of Water Quality Trigger Limits within the ESJWQC from October 2017 through September 2018.

Monitoring Location	Constituent	DO+	pH	SC	E. coli	Ammonia	Nitrate + Nitrite	Copper	Chlorpyrifos	Malathion	Water Flea	Fathead Minnow	Algae	Discharge Cubic Feet Per Second
	Water Quality Goal	5 or 7 mg/L	<6.5 or >8.5	>700 µmhos/cm	235 MPN/100 ml	1.5 mg/L (variable)	10 mg/L	µg/L (variable)	0.015µg/L	>0 µg/L	Toxicity	Toxicity	Toxicity	
	Sample Date													
Dry Creek @ Church St	4/9/18													14.16
	7/10/18													Dry
	8/14/18													Dry
	9/11/18													Dry
	10/10/17				248.1									13.53
	11/7/17													0
	12/5/17													Dry
	1/10/18	5.48			>2419.6									3.14
	2/13/18													Dry
	3/5/18													Dry
	3/20/18													NM
	4/9/18	5.56			1986.3			6.8 (4.95)						NM
	5/8/18	6.79			344.8									12.69
6/12/18	6.2												34.88	
7/10/18	5.07			579.4									14.54	
8/14/18				272.3									21.39	
9/11/18	6.78											Toxic	50.59	
1/10/18													Dry	
2/13/18													Dry	
3/5/18													Dry	
4/9/18													Dry	
10/10/17				488.4									Dry	
11/7/17													31.35	
12/5/17													0.47	
1/10/18													Dry	
2/13/18													Dry	
3/5/18					1986.3								Dry	
3/20/18													NM	
4/9/18					980.4								NM	
5/8/18				613.1									NM	
6/12/18				260.3									9.76	
7/10/18				517.2									6.87	
8/14/18	5.82												2.29	
9/11/18													3.12	
													1.74	
Dry Creek @ Rd 18														
Duck Slough @ Gurr Rd														

Exceedances of Water Quality Trigger Limits within the ESJWQC from October 2017 through September 2018.

Monitoring Location	Constituent	DO*	pH	SC	E. coli	Ammonia	Nitrate + Nitrite	Copper	Chlorpyrifos	Malathion	Water Flea	Fathead Minnow	Algae	Discharge
	Water Quality Goal Sample Date	5 or 7 mg/L	<6.5 or >8.5	>700 µmhos/cm	235 MPN/100 ml	1.5 mg/L (variable)	10 mg/L	µg/L (variable)	0.015µg/L	>0 µg/L	Toxicity	Toxicity	Toxicity	Cubic Feet Per Second
Unnamed Drain @ Hogin Rd	10/10/17	6.01		1780										NM
	11/7/17	6.16		2579										NM
	1/10/18	4.34		2120										0
	2/13/18			1378										0
	3/5/18	5.74		1638										0
	4/9/18	2.78		960										NM
	5/8/18	3.41		1212										0
	6/12/18	0.93		929										NM
	7/10/18	3.58		1011										0
	9/11/18	6.2		834										NM

DO* - The WQTL for DO is <5 mg/L for Ash Slough @ Ave 21, Berenda Slough @ Ave 2 1/2, Cottonwood Creek @ Rd 20, and Dry Creek @ Rd 18.
 Dry-No water at site; no samples collected.
 NM-No measurement: Too deep to measure flow or toxicity monitoring only.

Monitoring Constituents Definitions

Dissolved Oxygen (DO): DO criterion is protective of aquatic life: (min. of 7 mg/L). DO levels are affected by water temperature, photosynthesis & respiration. Added nutrients can stimulate algae production which dies and breaks down by microbial activity. The activity requires oxygen, depleting DO and resulting in an inability to support aquatic communities. pH: Power of Hydrogen (pH) measures acidic or basic levels in a solution. Acceptable range = 6.5-8.5. Water temperature, photosynthesis & respiration can affect levels. Fertilizers & pesticides can affect pH of water/ soil.

Specific Conductance (SC): A measure of salt and is measured in $\mu\text{S}/\text{cm}$. SC is an indirect measure of the presence of ions such as chloride, nitrate, sulfate, phosphate, sodium, magnesium, calcium and iron. The SC standard (700 $\mu\text{S}/\text{cm}$) is protective of sensitive agricultural crops such as beans.

Ammonia: Total ammonia consists of the unionized (NH_3) form plus the ionized (NH_4^+) form also called ammonium. Ammonium can enter a water body through direct discharge from agricultural fertilizers or animal waste, discharges from waste water treatment plants, or from the breakdown of organic matter in the stream. In soils, ammonium from fertilizers is typically converted to nitrite and then to nitrate over a short period of time. Exceedances of the ammonia standard are based on water temperature and pH which affect the level at which ammonia is toxic to aquatic life. Regardless of the water temperature or pH, all ammonia concentrations above 1.5 mg/L are exceedances of the drinking water standard.

Nitrate + Nitrite: Potential sources include runoff of fertilizers or organic matter from irrigated pasture, leaking septic systems, waste water treatment plant effluent and animal waste. Nitrate and nitrite are very soluble and can enter surface or groundwater with irrigation and/or storm water. Animal waste can be converted to nitrate by nitrifying bacteria. Sources of animal waste include dairies, poultry, pasture and/or wildlife.

E. coli: Common bacterium in intestinal tracts and voided in fecal matter. E. coli in water is compared to the water quality standard protective of recreational activities (235 MPN/100mL). E. coli may persist in presence of oxygen for periods of time after being voided. Any feces voiding species of vertebrate can contribute E. coli to surface waters. Potential sources: leaky septic systems or sewer lines, waste water treatment plant discharge, application of biosolids to ag land, defecation in or near waterbodies, dairies, manure or poultry operations.

Arsenic: Arsenic is found in sodium cacodylate which is applied by agriculture for broadleaf weed control and as a cotton defoliant. California Department of Pesticide Regulation records indicate no agricultural use of sodium cacodylate across the Coalition region between 1998 and 2010. Exceedances of the Arsenic WQTL can be attributed to legacy pesticide use.

Copper: Dissolved or sediment bound in water. Measurement of dissolved copper=dissolved form only measurement of total copper= both dissolved & bound. Dissolved copper is adjusted for the hardness (CaCO_3) in water to determine concentrations that would be toxic to aquatic species. Total copper is also evaluated based on the criteria protective of the drinking water beneficial use.

Molybdenum: Products containing molybdenum are rarely if ever used in the Coalition area. Molybdenum can be a byproduct in copper and tungsten mining and is used in alloys due to its ability to withstand high temperatures, resistance to corrosion, and weldability. The westside region is naturally elevated in molybdenum and tends to be flushed into surface waters during periods of high rainfall. Drains such as Prairie Flower Drain which were constructed to drain shallow ground water and allow agriculture can develop elevated concentrations of molybdenum when the ground water is driven into the channel. In living organisms, molybdenum acts as a metal heteroatom and is present in various enzymes including aldehyde oxidase, sulfite oxidase and xanthine oxidase. Molybdenum can also be found in green beans, eggs, sunflower seeds, wheat flour, lentils and cereal grains. In animal studies chronic ingestion of 10 mg/kg of molybdenum can cause diarrhea, growth retardation, sterility, low birth weight, and gout.

Chlorpyrifos: An organophosphate insecticide used in alfalfa, grapes & orchards (among other crops). Trademarked names include: Govern™, Lock-On™, Lorsban™, NuPhos™, etc. Chlorpyrifos can bind to sediment or remain in water column. The 0.015 $\mu\text{g}/\text{L}$ objective is protective of aquatic life.

Malathion: Malathion is an organophosphate insecticide applied to over 100 crops in the United States including alfalfa, rice, cotton, sorghum, wheat, and walnuts. It is also used for structural pest control (mosquito and fruit fly eradication, and home settings). Malathion is easily mixed with water and can be found in both urban and agricultural runoff. Malathion is a prohibited discharge pesticide except under the Rice Coalition Management Plan and any detection of the constituent is considered an exceedance. Malathion is known to be toxic to *C. dubia* ($\text{LC}_{50} = 3.35 \mu\text{g}/\text{L}$).

Algae toxicity: algae (aquatic plants) are sensitive to herbicides and fungicides. Algae toxicity is measured as percent growth in the sample water compared to the growth in a control treatment.

Fathead minnow toxicity: fathead minnows (fish) are sensitive to ammonia toxicity. At high concentrations pesticides and metals can also cause fish mortality. Fathead minnow toxicity is measured as percent survival within the sample water compared to survival in a control treatment.

Water flea toxicity: water fleas (invertebrates) are especially sensitive to water soluble pesticides such as chlorpyrifos & diazinon. Toxicity is measured as % survival in sample compared to survival in control treatment.

Sediment Toxicity: One species (*Hyalella azteca* — amphipod) is used in sediment analysis to determine toxicity that may occur to pelagic organisms. Amphipods are sensitive to pyrethroids and other pesticides that are not highly water soluble including some herbicides, fungicides and insecticides. Amphipod toxicity is measured as percent survival within the sediment sample as compared to the survival in a control treatment.



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Chief Financial Officer

Wayne Zipser
Grower Relations Manager

Caitie Campodonico
Grower Relations

Jennifer Sanchez
Membership Manager

Brittany Grogan
Grower Relations

Emily Coate
Membership Manager

Technical Consultants

MJ Environmental, Davis

Luhdorff & Scalmanini Consulting Engineers, Woodland

Legal Counsel

Tess Dunham
Somach Simmons & Dunn, Sacramento

Jill S. England, Attorney at Law
Creative Legal Solutions, Sacramento



1201 L Street, Modesto, CA 95354
209-846-6112
www.esjcoalition.org

