

# Findings and Recommendations of the Expert Review Panel for the Eastern San Joaquin Surface Water Monitoring Program

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## Acknowledgements

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## Executive Summary

The Central Valley Regional Water Quality Control Board (Regional Board) in 2012 adopted a General Order regulating waste discharges from Eastern San Joaquin (ESJ) irrigated lands via implementation of the Regional Board's Irrigated Lands Regulatory Program (ILRP). The Order contains a Surface Water Monitoring Program (the Program) to help the Regional Board assess whether growers in the ESJ region are meeting the ILRP's overarching goals. Environmental organizations (the Petitioners) subsequently filed a petition with the State Water Resources Control Board (State Board) contending that the Program is inadequate to determine whether water quality is being protected.

At the direction of the State Water Board, a five-member Expert Review Panel (the Panel) was convened to independently review the Program and assess its effectiveness. The Panel completed a comprehensive review of the Program over an approximately 10-month period, focusing on the General Order establishing the Program, the Program's monitoring design and implementation, the charge questions given to the Panel, the specific concerns raised by Petitioners, and other documents and presentations shared with the Panel. The Panel hosted three meetings – an in-person meeting in January 2020 and two online meetings in August and November 2020 – to gather information, perspectives and feedback.

The Panel concludes that the Program is, as a whole, adequate and appropriate to achieve the Program's overarching goals. Specifically, the Panel endorses the Program's overall monitoring design, data collection and analysis methods, adaptive nature, and use of data to inform management practices. While the Panel has endorsed the overall Program, the Panel recommends multiple changes to improve and strengthen the existing Program. Specifically, the Panel believes the Program should modify its approach to how current-use pesticides are monitored, adjust how dissolved oxygen is measured, revise the Program's approach to developing management plans, expand focused outreach to growers, and make minor modifications to how some types of Program data are displayed. The Panel believes these changes can be made while keeping the overall Program intact. For a more detailed overview of these key Panel findings and recommendations, see Table A, which includes callouts to specific sections of the report where the Panel's detailed findings and recommendations appear in full.

In arriving at this overall assessment, the Panel carefully weighed the concerns expressed by Petitioners about the Program's adequacy, as well as Petitioners' suggestions for modifying the Program. While the Panel believes some of the Petitioners' concerns and ideas will be addressed through implementation of the Panel's recommendations, the Panel believes that the Petitioners are seeking a fundamentally different monitoring program than the one that presently exists. Under the existing Program, when exceedances are triggered, management plans are developed that include focused outreach to all growers within the watershed that could be responsible for the exceedance. Petitioners have proposed a conceptual monitoring design that would enable exceedances to be tracked to individual growers within a watershed – a contrast to the existing Program that emphasizes collective grower responsibility for watershed-scale compliance.

While the Panel is aware of Petitioners' preference for a monitoring design that prioritizes holding individual growers accountable, the Panel concludes that a monitoring design that prioritizes watershed-

scale compliance is the preferred, superior choice for the ESJ region for three reasons: (1) The Panel believes the intent of the Program – as articulated in the General Order establishing the Program – is to work toward watershed-scale compliance, not individual grower compliance; (2) the ESJ’s limited hydrologic connectivity – in combination with the region’s soils and pesticide application practices – constrain options for alternative monitoring designs; and (3) the existing Program is a known quantity with an established track record. Thus, the Panel views the existing monitoring design as an efficient, cost-effective, practical option for the ESJ region.

**Table A.** Overview of the Panel’s key findings and recommendations.

	Main findings	Detailed findings/recommendations
Findings without recommendations	<b>Key Finding 3.1:</b> The Program is appropriately designed and implemented to meet the Program’s goals.	The Program’s reliance on core and represented sites is a technically sound approach for quantifying water quality status and trends, particularly given the particular flow and runoff patterns in the ESJ region.
		The Program is appropriately adaptive in nature, with a clear process for refining the program over time to account for constantly changing farming practices and pesticide-use practices.
		Data produced by the Program are appropriately being used by the Regional Board and the growers to adjust farming practices and address water-quality impairments.
		The Program is well-implemented, with appropriate quality assurance and data management systems.
Findings with recommendations	<b>Key Finding 3.2:</b> The measurement parameters and methods are inadequate for characterizing concentrations and biological effects of some current-use pesticides.	<b>Recommendation 3.2.1:</b> The <i>Chironomus sp.</i> toxicity test should be added to the Program.
		<b>Recommendation 3.2.2:</b> Analytical chemistry methods should be refined to ensure the Program is capable of detecting pesticides at biologically active concentrations.
		<b>Recommendation 3.2.3:</b> The Program’s Pesticides Evaluation Protocol (PEP) should be expanded to encompass the selection process for toxicity testing, analytical chemistry methods and temporal sampling density.
		<b>Recommendation 3.2.4:</b> An analysis should be conducted to understand whether grower changes to the pesticides being applied are leading the Program to improperly credit management plans for observed outcomes.
	<b>Key Finding 3.3:</b> The Program does not accurately quantify dissolved oxygen (DO) problems or provide appropriate insights about the degree to which agricultural practices contribute to low DO concentrations.	<b>Recommendation 3.3.1:</b> DO should be measured either continuously or at times of day when concentrations are likely to be lowest.
		<b>Recommendation 3.3.2:</b> Statistical analyses should be improved to enhance the insights provided by existing DO data.
		<b>Recommendation 3.3.3:</b> Additional eutrophication parameters, including Chlorophyll-a, should be measured.
	<b>Key Finding 3.4:</b> The Program’s approach to developing management plans – although generally appropriate and sound – results in coverage gaps.	<b>Recommendation 3.4.1:</b> Development of management plans and focused outreach should be expanded.
	<b>Key Finding 3.5:</b> Some types of data displays result in key information being lost or subject to mischaracterizations.	<b>Recommendation 3.5.1:</b> Trends should generally be graphed using constituent concentrations rather than exceedances.
		<b>Recommendation 3.5.2:</b> Precipitation curves should be added to trend graphs.
		<b>Recommendation 3.5.3:</b> Dry sites should be reported as “no data” rather than “no exceedance.”
		<b>Recommendation 3.5.4:</b> Any apparent trend lines should be the result of statistical analyses described in the report.

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## 1.0 Introduction

The Central Valley Regional Water Quality Control Board (Regional Board) uses a permitting process to regulate municipalities, businesses and industries whose discharge practices could impact the quality of surface and ground waters in the Central Valley. Discharges from irrigated agricultural lands are permitted under the Regional Board’s Irrigated Lands Regulatory Program (ILRP), a program designed to ensure that agricultural operations do not impair water quality. Growers are required to work either individually or through local water-quality coalitions to comply with discharge permit requirements, including preventing sediment, fertilizer, pesticides, manure and other materials used in agricultural activities from leaving the field via spray drift, irrigation runoff, stormwater runoff or other processes.

### **What is the Eastern San Joaquin River Watershed region?**

The ESJ region encompasses about 3,000 linear miles of surface water courses and 701,318 irrigated acres across multiple counties, including Madera, Merced, Stanislaus, Tuolumne and Mariposa. Within this region are 3,279 landowners and operators that are collectively represented by the ESJ Surface Water Quality Coalition.

The ESJ region encompasses multiple major river systems, including a portion of the San Joaquin River that drains to the San Francisco Bay-Delta.

In 2012, the Regional Board adopted a Waste Discharge Requirements General Order (the General Order) that implemented the ILRP within the Eastern San Joaquin River Watershed (ESJ) region. The 2012 General Order requires the approximately 3,300 growers represented by the ESJ Surface Water Quality Coalition (the Coalition) to administer a water-quality monitoring program known as the ESJ Surface Water Monitoring Program (the Program). The Program, which is ongoing, assesses water quality and toxicity through the range of agricultural conditions spanning a year; the overarching goal is to detect agricultural chemicals that exceed water quality objectives, document changes in condition over time, and measure the effectiveness of management actions to improve water quality.

Following implementation of the General Order for the ESJ region in 2012, environmental interests (the Petitioners) filed petitions with the State Water Resources Control Board (State Board) challenging the adequacy of numerous aspects of the General Order, including the Program’s design and reporting requirements. The Petitioners contend that the Program’s monitoring and reporting requirements do not support the feedback mechanism necessary for the Regional Board to determine if required management practices have a high likelihood of achieving receiving water-quality objectives. In response, the Coalition submitted an evaluation contending the Program is adequate and appropriate for protecting water quality.

The State Board reviewed the matter and, in 2018, issued a General Order directing the Regional Board to establish a public external expert review process for assessing the competing Program evaluations. In response, the Regional Board asked the Southern California Coastal Water Research Project Authority (SCCWRP), a public agency serving the water-quality management community, to convene and facilitate this panel review process. The Panel’s overarching charge was to evaluate the Program’s existing

monitoring and assessment framework and make recommendations for improvements and/or corrections as needed.

This purpose of this report is to provide a summary of the findings and recommendations of the Panel following its review of the Program. In Chapter 2, the Panel provides a summary of how the Panel was formed and the approach it took to reviewing the Program. In Chapter 3, the Panel provides the Panel's five key findings; embedded in these findings are the Panel's recommendations for improving specific areas of the Program. In Chapter 4, the Panel provides responses to Petitioners' proposals for redesigning the Program, including Panel responses to six main Petitioner concerns about the Program's adequacy.

### **Overview of the ESJ Surface Water Monitoring Program**

The Program conducts routine monitoring at a carefully selected set of sites that are known as either core or represented sites. Core sites represent the zone as a whole, while represented sites represent one or more sub-watersheds within the zone; water quality at represented sites and core sites is expected to be similar.

- The Program divides the ESJ region into six zones, each containing two core sites and one or more represented sites.
- Within each zone, one of the two core sites is monitored monthly for two consecutive years, and then the other core site is monitored for the subsequent two years. Core sites are monitored for physical parameters, nutrients, bacteria, pesticides, metals, water column toxicity and sediment toxicity.
- When a Water Quality Trigger Limit (WQTL) or toxicity threshold is exceeded, monitoring is initiated for two years at the associated represented site(s) for the parameter exceeding the WQTL. The Coalition also initiates focused outreach to growers in the sub-watershed(s) associated with the represented site exceedance.
- When two or more exceedances occur at a core site within a three-year period, or when there is a single exceedance of a total maximum daily load (TMDL) constituent, additional sub-watershed monitoring – known as management plan monitoring – is initiated to identify and address the potential source of the exceedance.

The Program also routinely engages in additional monitoring in the form of: (1) special projects designed to evaluate the effects of specific pesticides and/or management plans, and to identify sources of water quality impairment, and (2) annual storm sampling to characterize water quality during the highest flow periods.



## 2.0 Panel Formation and Approach to Reviewing the Program

Initiation of the Panel review process involved three key steps: (1) Development of charge questions for the Panel, (2) selection of experts to serve on the Panel, and (3) creation of an information exchange process, including a meeting structure, to ensure that the Panel had access to all the necessary information to reach a reasoned set of conclusions.

These three steps were conducted in coordination with a nine-member Stakeholder Advisory Group (SAG). The SAG consisted of three representatives each from the growers, the Petitioners, and the regulators (State and Regional Board), all of whom are affected by the Panel’s findings. Each of these interest groups was asked to self-select their SAG representatives (Table 2.1). The SAG helped ensure the review process was fair (i.e., that the Panel received accurate information and a range of viewpoints about effectiveness of the Program).

**Table 2.1.** Stakeholder Advisory Group members.

### **Agricultural Community**

Parry Klassen - East San Joaquin Water Quality Coalition  
Michael Wackman - Wackman Consulting  
Sarah Rutherford - Provost & Pritchard Consulting

### **Petitioners**

Sean Bothwell - California Coastkeeper  
Lisa Hunt - American Rivers  
Richard McHenry – California Sportfishing Protection Alliance

### **Regulatory Community**

Patrick Pulupa - Central Valley Regional Water Quality Control Board  
Adam Laputz - Central Valley Regional Water Quality Control Board  
Brianna St. Pierre - State Water Resources Control Board

## 2.1 Selection of Panel members

Candidates for the Panel were nominated by SCCWRP based on nationally recognized expertise and a requirement that they are not part of an organization that is directly associated with agricultural operations in the ESJ region or otherwise affected by the ESJ monitoring program. To ensure the Panel was well-rounded, candidates were grouped according to categories of expertise that SCCWRP developed in partnership with the SAG: (1) Aquatic ecotoxicology, (2) environmental chemistry, (3) regulatory/non-point source program implementation, (4) monitoring program design and implementation, and (5) agronomy and agricultural practices. At least five candidates were nominated for each category. The SAG then ranked the nominated panelists within each category. In addition, each member of the SAG was given the opportunity to eliminate any of the candidates from consideration if they felt the candidate was either insufficiently qualified and/or had pre-existing bias regarding the

issues on which they would deliberate. The finalists who were ultimately selected and agreed to serve were all top consensus picks by the SAG.

## 2.2 Development of Panel charge questions

The Panel's charge questions were developed in consultation with the SAG. In developing these questions, the SAG and SCCWRP used as their starting point the questions the State Board identified in the 2018 Order calling for the Panel's formation. The State Board questions were modified both for clarity and to address additional items that the SAG members felt would be valuable, resulting in four final charge questions and a number of sub-questions associated with each (see Table 2.2).

**Table 2.2.** Charge questions for the ESJ Panel. The answers to these charge questions appear in the appendix of this report (see Section 5.1).

**Charge Question 1:** Is there a clear linkage between the six surface water monitoring program questions and the decisions that will be made by the Central Valley Water Board, the ESJWQC, and the ESJWQC's members?

**Charge Question 2:** Is the ESJ monitoring framework appropriate to answer the ILRP's questions?

- **Subquestion 2a:** Is the monitoring program design, including the reliance on use of core and represented sites, a technically sound approach?
- **Subquestion 2b:** Are the criteria presently being used to select represented sites appropriate?
- **Subquestion 2c:** Are the monitoring sites of sufficient spatial density to identify general locations of potential pollution resulting from irrigated agricultural waste discharges?
- **Subquestion 2d:** Are the monitoring sites of sufficient temporal intensity to identify potential trends in pollution resulting from irrigated agricultural waste discharges?
- **Subquestion 2e:** Are the monitoring parameters and measurement methods suitable to address the six ILRP monitoring questions?

**Charge Question 3:** Is there a mutual understanding of how the monitoring data are going to be used by the Central Valley Water Board and the ESJWQC, individually and collectively?

- **Subquestion 3a:** Are the data submission requirements appropriate?
- **Subquestion 3b:** Are the data integration approaches, and thresholds for assessment, appropriate?
- **Subquestion 3c:** Is the translation process from data into potential actions clear, including the possible triggering of enhanced monitoring for source attribution or enhanced spatial/temporal pattern description?
- **Subquestion 3d:** What iterative processes for evaluating monitoring program effectiveness could be implemented for continuous improvement?

**Charge Question 4:** If revisions to the program are recommended, are there steps that should be taken to incorporate compatibility with historic information?

### 2.3 Panel meetings and deliberations

SCCWRP worked with the SAG to develop a series of Panel meetings that would provide both factual information and a series of perspectives that different parties wished to convey to the Panel. The agendas for these meetings appear in the appendix (see Section 5.3).

- **First Panel meeting:** The first Panel meeting was a three-day, in-person meeting held January 7-9, 2020. The meeting was organized around providing the information and perspectives that the SAG wanted to communicate to the Panel. On the first day, the Panel heard a series of public presentations introducing the Program, and heard two competing evaluations of the Program and other perspectives from stakeholders. On the second day, the Panel toured multiple ESJ monitoring sites during an all-day field trip that also was open to the public. On the third day, the Panel deliberated behind closed doors, then reported out publicly on its initial impressions of the review process and its approach to deliberations.
- **Second Panel meeting:** The second Panel meeting was a three-day, remote meeting held August 24-26, 2020. The meeting was organized around providing the follow-up information and perspectives that the Panel requested from stakeholders. On all three days, the Panel heard a series of morning presentations, then recessed to closed session to deliberate and work toward consensus on its initial findings and recommendations. On the third day, the Panel verbally reported out on the initial findings and recommendations.
- **Third Panel meeting:** The third Panel meeting was a one-day, remote meeting held November 6, 2020, three weeks after the Panel released its draft report for public comment. The meeting was used to solicit public comments and ensure that the report was clearly written and devoid of errors based on any Panel misunderstandings of fact. Then, the Panel met in closed session to discuss feedback and to make changes to the report based on this feedback. The final Panel report was published on December XX, 2020, XX weeks after the third meeting.

During their deliberations, Panel members were encouraged – but not required – to come to consensus. Panel members were told that if they couldn't come to agreement on one or more topics, the final Panel report would reflect these divergent viewpoints. In the end, the Panel reached full agreement on all of the areas discussed; hence, this report represents unanimous Panel agreement.

During its review of the Program, the Panel was instructed by the Regional Board not to assess the Program's effectiveness in monitoring pathogens, as this assessment already was being conducted through other mechanisms, and not to assess the Program's effectiveness in monitoring nitrogen, as the State Board was in the process at the time of developing policies for biostimulatory substances.

## 3.0 Panel’s Key Findings and Recommendations for Improvement

The Panel’s assessment of the Program’s design and implementation resulted in the development of five main findings. The first finding (Key Finding 3.1) addresses adequacy and appropriateness of the overall Program design and implementation. The other four findings (Key Findings 3.2-3.5) focus on more detailed Program aspects that the Program should modify; included alongside each of these latter four findings is one or more Panel recommendations to improve the Program.

### Key Finding 3.1: The Program is appropriately designed and implemented to meet the Program’s goals

The Panel concludes that the Program is, on the whole, appropriately designed and implemented to meet the monitoring program goals laid out in the 2012 Order, including the ILRP goals and objectives and the monitoring questions that must be addressed through the Program. Moreover, the Program’s design and implementation are appropriate for the physical characteristics and agricultural practices of the ESJ region (see Section 4.1 for more information about how the Panel arrived at this conclusion). The Program should continue to use the existing overall design, except as modified by the Panel’s recommendations (see Key Findings 3.2 through 3.5). In its assessment of the Program, the Panel made a number of specific observations about design and implementation:

#### 3.1.1 Sampling design

The Panel finds that the Program’s reliance on core and represented sites is a technically sound approach for quantifying water quality status and trends, particularly given the flow and pesticide transport patterns in the ESJ region. Although many watershed monitoring programs are characterized by linear sampling strategies – where sampling sites are aligned from upstream to downstream to follow the flow of water – the Panel does not support the use of this type of program for the ESJ region. The Panel was provided with convincing evidence that because of hydrologic disconnections within the system, such an approach would not be effective in achieving Program goals. In addition to the ESJ region’s naturally arid conditions, the region also experiences relatively little dry-weather runoff from most individual farms because of soil characteristics in the area that cause watering operations to drain to groundwater rather than to surface water. While there are a limited number of days per year – particularly following extended rainfall events – when there is widespread hydrological connectivity, the Panel feels that it is infeasible to design a year-round program around these infrequent events, which are difficult to predict and logistically challenging to effectively measure. Given the lack of hydrological connection for most of the year between downstream sites and most upstream sites, a represented watershed approach is an appropriate monitoring design.

#### 3.1.2 Adaptive management

The Panel is impressed with the adaptive nature of the Program, noting that the Program uses a clear process for making refinements over time to account for constantly changing farming practices and pesticide-use practices. The Regional Board and the Coalition annually review pesticide use reports, as well track trends in the monitoring data, to determine what constituents should be measured and whether additional sampling sites should be added as part of special studies to better understand

observed patterns. Although the Panel has specific recommendations for strengthening the Program's Pesticides Evaluation Protocol (see Recommendation 3.2.2), the Panel views the adaptive nature of the Program overall as a key strength.

### **3.1.3 Program effectiveness**

The Panel finds that the Program routinely produces actionable information. The Panel heard multiple case studies during Panel meetings, and reviewed written reports for many others, illustrating specifically how data produced by the Program are being used by the Regional Board and the Coalition to appropriately support improvements to farming practices and reduce water-quality impairments. The Panel's approach to identifying constituents with exceedances and conducting outreach to all operations within the watershed is an efficient and extensive approach to promote proper management practices by a large number of growers. When exceedances of water quality objectives are detected, the Program: (1) identifies agricultural operations that use the identified constituents in the sampled watershed, (2) conducts site inspections to identify potential transport pathways, and (3) recommends and encourages changes to management practices to minimize constituent discharge to State waters. Although the Program's approach to developing, tracking, and completing management plans when exceedances are triggered has, as a whole, worked well for pesticides applied by growers and measured at biologically relevant concentrations, the Panel has identified multiple weaknesses that should be corrected (see Key Findings 3.2-3.5), including ensuring that critical exceedances do not go undetected due to inadequate toxicity testing and/or analysis.

### **3.1.4 Quality assurance and data management**

The Panel finds that the Program is well-implemented from a quality assurance and data management system perspective. Coalition staff and associated contractors have a thorough understanding of the Program goals, the underlying purpose for each element of the Program, and the necessary expertise to collect the data properly. While the Panel has recommended multiple specific revisions to the sampling, laboratory and analysis methods under the existing Program (see Key Findings 3.2-3.5), the Panel has a high degree of confidence that the existing methods are consistently being implemented correctly by the data collection team, producing Program data of consistently high quality.

#### **Transferability of the Program**

Although this Program as designed and implemented is appropriate for the ESJ region, the Program is not necessarily transferrable to other regions of California. The geography, hydrology and grower operations in the ESJ area are different from those in other regions of California. These factors can influence the transport pathways, fate and effects of applied pesticides. As a result, if agricultural monitoring programs in other parts of California are considering whether the findings and recommendations of this review are applicable elsewhere, the Panel recommends carefully considering differences in geography, hydrology, pesticide application practices, and transport processes.

For example, the limited precipitation and large expanses of sandy soil in the ESJ region allow much of the rainfall to soak into the ground, substantially limiting the possibility of field runoff events

transporting pesticides to State waters. In contrast, spray drift has been identified in the ESJ region as a dominant pathway for pesticide transport to surface waters. Aerial pesticide applications by ground-based farm equipment are common because of the large acreage dedicated to orchard and vine crops. These transport events, however, are of limited duration and occur less continually than field runoff from irrigated lands in other regions. As a result, the management plans in the ESJ region are more likely to focus on spray drift (i.e., by targeting equipment, timing and application technique).

**Key Finding 3.2: The Program’s measurement parameters and methods are inadequate for characterizing concentrations and biological effects of some current-use pesticides**

The Panel finds that the Program’s existing toxicity tests do not use organisms sufficiently sensitive to select current-use pesticides, and the Program does not incorporate analytical chemistry methods capable of detecting select pesticides at concentrations that are toxic to test organisms. The impact of these shortcomings is twofold: First, toxicity testing under the existing Program has not kept up with changing pesticide use practices. Second, the Program has not been future-proofed to ensure the Program can adequately adjust its measurement parameters and methods going forward to keep up with future changes in pesticide usage.

The Panel has developed four recommendations for addressing these shortcomings. The first three recommendations (Recommendations 3.2.1-3.2.3) are intended to improve the Program’s ability to characterize concentrations and biological effects of some current-use pesticides. The fourth recommendation (Recommendation 3.2.4) is intended to confirm that successful completions of management plans in the ESJ region are due to improved management practices in the ESJ region that are driving water-quality improvements. The Program operates under the assumption that management plan completion and downward trends in exceedances of certain chemicals are indicative of water-quality improvement, but the Panel notes that it is also possible that changes in the types of pesticides applied could result in the application of new pesticides that are not well characterized by the Program and that could lead to similarly problematic water quality impairments. For example, if ESJ growers are periodically switching pesticides as new products come onto the market, usage of older pesticides would be expected to decline over time, which could trigger the successful completion of management plans that have been optimized to monitor now-obsolete pesticides. In this scenario, the Program’s ability to successfully complete multiple management plans would result from pesticides falling out of use, not on the Program’s positive influence on ESJ management practices. While the Panel recommends confirming that improvements to management practices are driving water-quality improvements, the Panel is not opposed to pesticide switching, especially opportunities to replace a pesticide that is having adverse impacts on receiving water quality with one that has less adverse impacts. To reiterate, the Panel emphasizes that pesticide switching can be a valid, appropriate component of management plans. At the same time, it also becomes necessary to demonstrate that the pesticides replacing those being phased out are not also adversely impacting water quality.

**Recommendation 3.2.1: The *Chironomus sp.* toxicity test should be added to the Program**  
The current toxicity testing regime includes the water flea *Ceriodaphnia dubia*, the crustacean *Hyalella azteca*, the fathead minnow *Pimephales promela* and the green alga *Selenastrum capricornutum*. Although these tests are appropriate for a range of contaminants, none of them are sufficiently sensitive to many pesticides.

The Panel recommends addition of the *Chironomus sp.* toxicity test to close a gap in the current testing regime. The *Chironomus sp.* test is more sensitive to some of the more modern insecticides, including neonicotinoids that are current-use pesticides in the ESJ region. Although the inclusion of this test for both water and sediment will add to existing toxicity testing efforts, toxicity testing is only valuable if the organisms used in the test are sufficiently sensitive to target contaminants that may be present in the samples. In the absence of sufficiently sensitive species, it is possible that exceedances could go undetected. The Panel recommends adding the *Chironomus sp.* toxicity test for both water and sediment in the short term. Over the long term, the Program should reevaluate the need to continue doing sediment toxicity testing with *Chironomus*, as water column testing is likely the more appropriate approach for the highly soluble neonicotinoids. The Program should reevaluate the long-term need for *Chironomus sp.* sediment testing using Panel-developed guidance for selecting toxicity tests (see Recommendation 3.2.3).

The Panel received comments that the *Chironomus* test is not yet ready for application to the Program because it is not yet EPA-approved, is not accredited by the State's Environmental Laboratory Accreditation Program (ELAP), and will not produce reliable, actionable results. The Panel disagrees with this assessment. *Chironomus* testing methods are in common use by multiple laboratories statewide, and have been adopted by the State's Surface Water Ambient Monitoring Program (SWAMP). As with other water and sediment samples, the Regional Board should involve ELAP to ensure high-quality data are generated, and should only use laboratories that have demonstrated competency to the satisfaction of the Regional Board to reliably perform the test.

**Recommendation 3.2.2: Analytical chemistry methods should be refined to ensure the Program is capable of detecting pesticides at biologically active concentrations**

Analytical chemistry methods should be sensitive enough to accurately measure chemicals in environmental samples at concentrations that cause toxicity to aquatic organisms. Measured toxicity in water or sediment samples can be associated with particular chemicals only if these chemicals can be accurately measured in the samples at concentrations responsible for toxicity. The analytical chemistry methods used in the Program have detection limits well above concentrations at which certain pesticides are toxic to aquatic organisms (i.e., the biologically active concentration), particularly for synthetic pyrethroids in sediment and neonicotinoids in water.

The Panel heard concerns at its meetings that a regulatory monitoring program should be constrained to only using methods approved by authoritative bodies (e.g., USEPA, AOAC, ASTM, USGS). However, the Panel recommends use of non-standard methods as necessary to improve detection limits to levels that are biologically relevant, and recognizes that there are many methods in routine use at academic,

industry and government laboratories that will achieve this. The Regional Board has flexibility to approve non-standard methods if laboratories submit a performance-based validation of their procedure to the Regional Board for approval (PRG-1, QAPP guidelines). Where current analytical technology is incapable of achieving the low detection limits equivalent to concentrations of biological activity (e.g., sediment methods for pyrethroids), the Panel recommends that the reports note that pesticides that could be responsible in toxic samples were not measurable at levels of potential biological concern with the methods used.

### **Recommendation 3.2.3: The Program’s Pesticides Evaluation Protocol (PEP) should be expanded to encompass the selection process for toxicity testing, analytical chemistry methods and temporal sampling density**

The Panel finds that the process for selecting which pesticides to monitor for the upcoming year – known as the Pesticides Evaluation Protocol (PEP) – is logical and appropriate as the whole. However, the Panel recommends expanding the PEP to encompass other key decisions being made by the Program in developing pesticide monitoring plans. Once pesticides have been selected via the PEP process (see the [seven steps of the existing PEP](#)), the Panel recommends adding three additional steps that enable the Program to evaluate:

- 1) The appropriateness of the toxicity tests used in monitoring, which will determine if the toxicity tests are using species sufficiently sensitive to pesticides selected for the upcoming year
- 2) The appropriateness of the analytical chemistry method sensitivity, including taking into consideration pesticide toxicity endpoints (see Recommendation 3.2.2), which will determine if the analytical chemistry methods for the selected pesticides will be able to detect them at concentrations causing toxicity to test organisms
- 3) Sampling timing and frequency, including taking into consideration pesticide environmental fate properties, which will determine if samples are going to be collected in appropriate matrices (sediment or water) and at intervals allowing detection based on an individual pesticide’s partitioning and degradation in regulatory studies (e.g. hydrolysis, aerobic soil metabolism, water-sediment degradation, field soil dissipation, etc.)

The current PEP for the ILRP selects pesticides for monitoring each year based on: (1) prior use patterns, (2) an assessment of potential toxicity based upon aquatic life reference values (ALRVs), and (3) availability of analytical methods for their analysis in water and sediment. The PEP includes detailed information about a pesticide’s available analytical methods, physical and chemical properties and environmental fate data and toxicity information. This information, however, is not being systematically and fully leveraged by the Program. Through an expansion of the PEP, the Program will be better-positioned to proactively identify and remediate gaps in pesticide monitoring. For example, the year neonicotinoids were selected for monitoring, the expanded PEP process would have allowed the Coalition and Regional Board to identify that the existing battery of toxicity tests would not provide sufficient sensitivity to neonicotinoids, which would have paved the way for adding a *Chironomus sp.* test in water. Additionally, the expanded PEP process would have identified that the analytical methods used for neonicotinoids were not sensitive enough to detect concentrations in water that would be



responsible for toxicity, which would have paved the way for the Program to recognize the need for more sensitive analytical chemistry methods. Looking to the future, the Panel believes the proposed PEP expansion will enable the Program to assess testing appropriateness for future “next-generation” classes of pesticides with potentially novel modes of action.

The expanded PEP process will have the added benefit of increasing Program efficiency by allowing the potential elimination of certain toxicity tests based upon the pesticides monitored in a particular year. For example, if an evaluation of the appropriateness of toxicity testing (Step 8) for pesticides selected in Steps 1-7 reveals that the fat-head minnow *Pimephales promela* is relatively insensitive compared to other tested species, this test could be dropped from the monitoring program for that particular year. Similarly, such an evaluation might find that only *Chironomus* water toxicity testing is necessary that year, but that *Chironomus* sediment toxicity testing is not.

### **Panel’s Recommendation for Expanding the Pesticides Evaluation Protocol (PEP)**

#### *Additional steps to be added to the PEP’s step-by-step instructions*

After pesticides are selected in Steps 1-7 of the PEP, the Panel recommends completing the following three additional steps for each pesticide. These additional steps will enable the Program to evaluate the appropriateness of toxicity tests, analytical methods and sampling intervals used. These steps are intended to guide testing and sampling design, and are illustrated via a Panel-created flow chart (see Figure 3.1).

#### **STEP 8. Toxicity test appropriateness evaluation**

Evaluate the aquatic life reference values (ALRVs), assuming these are based on the most updated toxicity information, and the LC<sub>50</sub> for toxicity test species for each selected pesticide. Determine if species in toxicity tests are sufficiently sensitive (i.e., have LC<sub>50</sub> values approaching the ALRVs) for the selected pesticide (see “Prioritizing and Selecting Pesticides for Surface Water Monitoring,” [ILRP Pesticides Evaluation Protocol](#), November 2016).

- If tests are sufficiently sensitive, note the LC<sub>50</sub> value) of the most sensitive test as compared to the ALRV.
- If test species are not sufficiently sensitive (i.e., LC<sub>50</sub> of the species is substantially higher (e.g., 10 times) than ALRVs for the selected pesticide), incorporate the toxicity test for the most sensitive species for the pesticide into the Program. If a standard test is not available, note the need for future development of this test.

#### **STEP 9. Analytical chemistry method appropriateness evaluation**

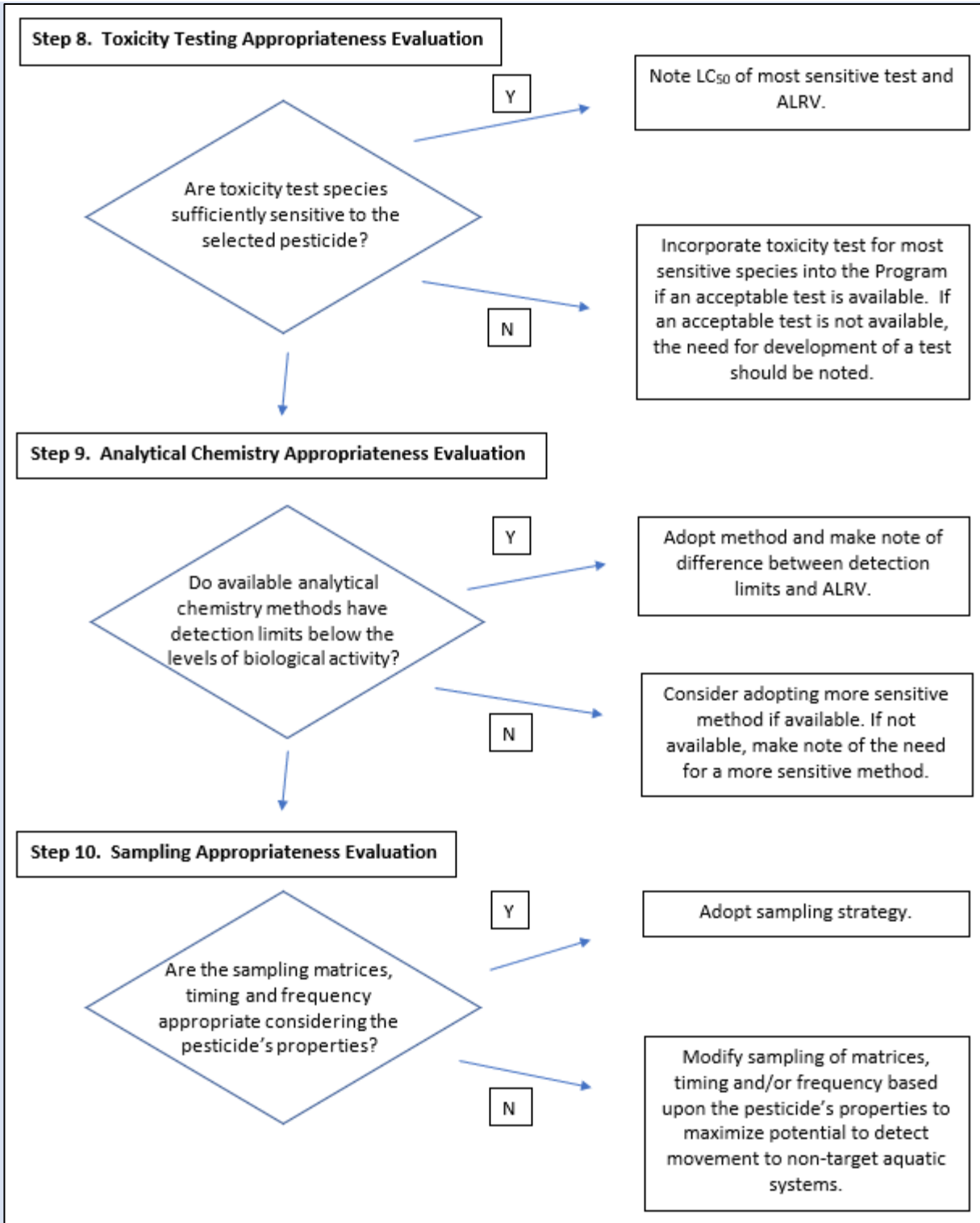
Determine if the methods selected from step 6 have detection limits less than or equal to the ALRVs. Detection limits should ideally be well below (e.g., 10X or 100X) the ALRV.

- If methods from step 6 are sensitive enough to measure the pesticide at the ALRV, they will be considered sufficient.

- If methods from step 6 are not sensitive enough to measure the pesticide at the ALRV, adopt an appropriate method that will be sensitive enough to detect the pesticide at this concentration in accordance with the prior recommendation (see Recommendation 3.2.2).
- If an appropriate method with sufficient sensitivity is not available, highlight this fact when reporting monitoring results.

**STEP 10. Consider pesticide fate in determining matrices for analysis and sampling timing and frequency.**

Based upon physical-chemical properties and environmental fate information gathered in Step 4 (e.g., field soil dissipation, water-sediment degradation), determine for each pesticide the appropriate matrices in which each pesticide should be measured (water, sediment or both). Determine the appropriateness of sampling timing and frequency considering these properties.



**Figure 3.1.** Three additional steps the Panel recommends adding to the Pesticides Evaluation Protocol. (Note: The assumption is that the ALRV is representative of the level of biological activity to the most sensitive species in regulatory and literature toxicity tests.)

**Recommendation 3.2.4: An analysis should be conducted to understand whether grower changes to the types of pesticides being applied are leading the Program to improperly credit management plans for observed outcomes**

The Program presented evidence that water quality improved as a result of decreased detections of the insecticide chlorpyrifos over time (Turner, [August 24, 2020 presentation](#) to the Panel). While the Panel agrees the data showed that detections of chlorpyrifos decreased over time, the Panel recognizes that this trend also could be explained by pesticide-use changes that reduced chlorpyrifos applications, while simultaneously increasing applications of newly available pesticides. In other words, if other insecticides such as pyrethroids or neonicotinoids replaced chlorpyrifos, and if these other chemicals were not adequately detected through either toxicity testing or direct chemical analysis of water and/or sediment samples, then it would be difficult to assert that the Program was responsible for water-quality improvements. While the Panel believes that pesticide switching can be an appropriate, valid component of management plans, especially when replacing a pesticide having adverse properties with one having less adverse properties, the Panel believes it is simultaneously necessary to demonstrate that the pesticides replacing those being phased out are not also adversely impacting water quality. Similarly, it is important that the suite of toxicity tests selected are appropriate and that toxicity trends are properly tracked (see Recommendations 3.2.2 and 3.2.3).

The Panel recommends conducting a retrospective analysis of historical data on pesticide use and exceedances to understand whether changing pesticide usage is leading the Program to falsely conclude that water quality is improving. This analysis could be easily completed by retrieving historic pesticide-use and exceedance data using pesticide use reports within the management plan area. In the chlorpyrifos example above, the analysis would determine whether chlorpyrifos reductions are due to reductions in chlorpyrifos transport in waterways vs. less use of chlorpyrifos overall as other chemical usage increases.

**Key Finding 3.3: The Program does not accurately quantify dissolved oxygen (DO) problems or provide appropriate insights about the degree to which agricultural practices contribute to low DO concentrations**

The Panel finds that the existing Program is underestimating the extent of the DO problem. DO concentrations vary diurnally, with the lowest concentrations typically occurring around dawn. Sampling during daylight hours, when photosynthesis is producing oxygen, is likely to not capture the lowest values of the day, which should be the sampling goal. Moreover, factors such as aeration associated with winds or flows, and temperature, can also affect DO concentrations. Because the primary goal of capturing DO measurements is to ascertain whether concentrations are below levels of biological concern, the Program needs an improved strategy for determining if, and for how long during the day, DO conditions are outside objective limits.

The Program should make three changes to how it approaches measuring DO levels in waterways in the ESJ region and then makes use of these DO data to generate managerially relevant insights. In particular, the Program should be making better use of DO data to shed light on the degree, if any, to which growers are contributing to low DO conditions in the region's waterways.

**Recommendation 3.3.1: DO should be measured either continuously or at times of day when concentrations are likely to be lowest**

The Panel recommends deployment of continuous recording devices that shed light on how DO varies across time of day, or taking all point measurements during the early morning when DO levels are expected to be lowest. The Panel recognizes that continuous measurement devices are potentially subject to vandalism, and that sampling all locations at a specific time of day is logistically challenging given the wide spatial distribution of sites. As such, the Panel suggests that an acceptable first step could be to develop an understanding of temporal patterns at a subset of sites that are less subject to vandalism or where it is more logistically feasible to conduct repeated sampling over the course of a day. The temporal patterns at these sites, provided there are a sufficient number to capture across-site variability, can then be used to model a correction factor for daylight measurements at other sites.

**Recommendation 3.3.2: Statistical analyses should be improved to enhance the insights provided by existing DO data**

The Program's approach to assessing the contributions of agriculture to observed low DO and hypoxia does not properly consider diurnal variability in DO patterns and should be improved going forward. The Program should account for this variability by using a subset of DO data that was collected at nearly the same time of day. The preferred approach is to use only DO data collected in early morning; an alternative is to adjust the data for likely diurnal changes in oxygen concentration as a function of time of day (see prior recommendation above).

Exceedances of the DO threshold are common in the ESJ region and are an issue identified by the Petitioners. The Coalition presented a logistic regression analysis based on the USEPA CADDIS framework to evaluate causation (Johnson, [August 24, 2020 presentation](#) to the Panel). That analysis, which included 1,200 sampling events from 25 stations, did not reveal any strong correlations and explained only 19% of the variation within the data set. However, the Panel believes that diurnal variability in the DO patterns confounded the analysis, serving as one of the reasons for the low correlation and lessening the viability of any conclusions about the contribution of farming practices drawn from those analyses. Limiting analyses to data collected in early morning, or adjusting mid-day data to the presumably lower values that would occur in the morning (if there is enough information to make such corrections), would improve these causal assessments. The Panel also believes the analysis would be strengthened by using measured DO concentrations rather than the coded DO concentrations (exceedance = 1, acceptable = 0) used in the analysis presented to the Panel. Such data mining will not be as effective as taking the diurnal measurements described in Recommendation 3.3.1, but the Panel recommends this approach because: (1) it can be accomplished in the short term, (2) it may help determine how much and at what sites additional data collection would be most beneficial, and (3) it provides a mechanism for using historical data even after new, more temporally intensive data are available.

**Recommendation 3.3.3: Additional eutrophication parameters, including Chlorophyll-a, should be measured**

The Program should measure additional parameters to assist in quantifying the potential contributions of farming practices to DO conditions. At a minimum, the Panel recommends adding analysis of Chlorophyll-a concentration in the water column and recording observations about the extent of benthic or suspended filamentous algae near each sampling site. This additional sampling might also include other eutrophication measures in an adaptive monitoring context at sites where hypoxia is most severe or where the continuous oxygen measurements indicate the greatest amount of diurnal variation.

DO deficits are apparent throughout the ESJ region. The Coalition has stated that these deficits result primarily from groundwater and dairy practices, and that biostimulation of plant growth via nutrients associated with fertilizer plays a minor role. However, the Program has not produced the data necessary to validate this assumption. The Panel recommends that the Program gather the data necessary to make this assessment, including collection of additional parameters. The Panel believes that Chlorophyll-a will be the most valuable parameter to start measuring, although additional measurements could include flow, TOC,  $\text{NO}_3^-$ ,  $\text{PO}_4^{3-}$ ,  $\text{NH}_4^+$ , temperature and specific conductance. That said, measurements beyond Chlorophyll-a may not be needed at all sites and might be conducted as an adaptive response to conditions at individual sites. Because the Panel recognizes that dairy practices could be contributing to DO deficits as much or more than farming practices, the Panel suggests that the collection of additional data necessary to support the correlative analysis could become a shared responsibility among multiple parties. Better established findings would serve to either: (1) guide a management plan for DO, or (2) support a conclusion that a management plan is not warranted because of lack of contribution of on-farm practices to observed conditions.

**Key Finding 3.4: The Program’s approach to developing management plans – although generally appropriate and sound – results in coverage gaps**

The Panel finds that when an exceedance is triggered in a zone, management plans and focused outreach should be expanded so that all potential sources of discharge to ephemeral and perennial waterways within this zone are targeted. The Coalition’s existing focused outreach efforts – designed to target growers located only in sub-watersheds that have core and/or represented sites – do not reach all potential dischargers in the zone where an exceedance has occurred.

**Recommendation 3.4.1: Development of management plans and focused outreach should be expanded**

The Program does not target all potential discharge sources under its existing approach to developing management plans and focused outreach, even though the underlying assumption of the Program’s monitoring design is that an exceedance anywhere in a zone is indicative of exceedances across the zone. The six zones in the ESJ region were set up with the assumption that growers in each zone have similar crops, management practices, soils, depth to groundwater and precipitation. Because the Coalition asserts that each monitoring site (or cluster of sites) in a zone is representative of the entire zone, the Panel has concluded that an exceedance anywhere in a zone is likely indicative of potential exceedances across the entire zone. However, when an exceedance is detected, the Program presently

develops management plans and focused outreach for just the sub-watershed(s) where the exceedance has been detected (i.e., only for the portions of the zone that are above the site where the exceedance was detected). Thus, the Program lacks a mechanism for assessing whether management plans and focused outreach are needed in areas of the zone where no water quality testing is performed. These additional potential dischargers (i.e., growers that meet the focused outreach criteria and that have the potential to discharge into an ephemeral or perennial waterway) can be identified with the help of pesticide use reports and spatial data that consider the possibility of pesticides reaching an ephemeral or perennial waterway. The Panel recommends that management plan development should address all potential exceedances across a zone, including areas within the zone that are not subject to water quality testing.

For example, if an exceedance is detected at the core site in Zone 6 (see Figure 3.2; Cottonwood Creek @ Road 20), the logical assumption is that the exceedance could occur across Zone 6 in both the other sub-watersheds that have represented monitoring sites and in the other areas of the zone that are not monitored (the light orange areas). While testing at the represented sites may show that a particular sub-watershed is not in exceedance, this would not imply that other areas in the zone lacking represented sites are not in exceedance. It only means that this particular sub-watershed had no detectible exceedances, and thus that no focused outreach is needed for this particular sub-watershed. Management plans and focused outreach would still need to be conducted in all other areas of the zone, unless they meet the following three criteria: (1) The grower's area contains sandy soils (identified in lighter color shades; see Figure 3.2) that do not have the potential to discharge into an ephemeral or perennial waterway (Johnson, [January 7, 2020 presentation](#) to the Panel); (2) the grower does not use the pesticide (as determined through a review of pesticide use reports) and thus does not have the potential to discharge the pesticide that is the source of the exceedance; and (3) the grower does not have the potential to discharge because the fields that use the pesticide are sufficiently distant from any ephemeral or perennial waterways. In sum, all growers in Zone 6 that have the potential to discharge into an ephemeral or perennial waterway, that meet the focused outreach criteria, and that are not in a sub-watershed where sampling shows no exceedance should be targeted for focused outreach.

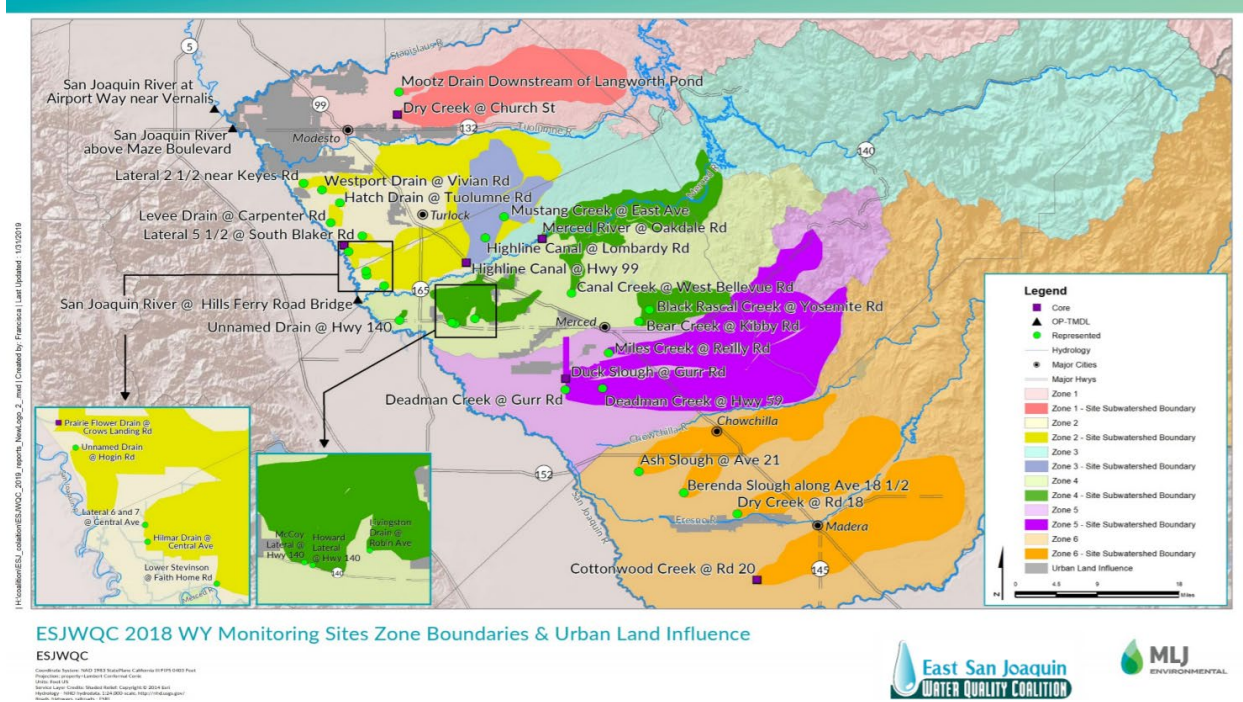


Figure 3.2. The six monitoring zones of the ESJ region.

Key Finding 3.5: Some types of data displays result in key information being lost or subject to mischaracterizations

The Panel finds that the Coalition’s data management efforts – including collection practices and validation/verification – were generally well done, and met the expected level of quality control. Where the Panel recommends improving the data management system is in data trend displays. Key information is being lost and subject to mischaracterizations for some types of data displays, including some of the displays presented to the Panel during this review process. Specifically, several of the Coalition graphs and presentation materials had issues with data grouping, qualitative trend line display, and mislabeling of failed collections due to lack of water availability.

The Coalition has responsibility to not only collect data accurately, but also present the data in a clear and representative fashion that accurately portrays the results. This reporting responsibility extends to the Regional and State Board, which may republish the data displays, as well to the Petitioners, which may present their own analyses of Program data. Thus, the Panel has developed a set of four recommendations for improving data displays.

Recommendation 3.5.1: Trends should generally be graphed using constituent concentrations rather than exceedances

Displaying the number of exceedances rather than the actual constituent concentrations has the effect of masking the underlying data set. There is usefulness in seeing the actual concentration values, as well



as any grouping or characterization of the data. Although there are reasons for presenting exceedance data for some analyses, more information is accessible in general when using concentrations.

**Recommendation 3.5.2: Precipitation curves should be added to trend graphs**

Given the direct relationship of precipitation to the hydrology and monitoring data results, such information should be consistently displayed (when appropriate) when presenting data. In particular, precipitation data should be averaged over appropriate time intervals. The Panel finds it difficult to interpret some of the data presentations without an understanding of the underlying precipitation events. For example, the Panel was presented with a Coalition graph where monthly precipitation data were overlaid on exceedance data presented as annual averages (see Figure 3 of the Coalition’s [August 3, 2020 updated Technical Memo](#) to the Panel); the Panel found it difficult to extract the insights it was seeking from this graph.

**Recommendation 3.5.3: Dry sites should be reported as “no data” rather than “no exceedance”**

A “no exceedance” determination implies data have been collected and the results are conclusively below threshold levels. Such a representation should not be used otherwise. When data cannot be collected due to a lack of water at a monitoring site when sampling is scheduled to occur, such information should be presented as “no data” or equivalent language.

**Recommendation 3.5.4: Any apparent trend lines should be the result of statistical analyses described in the report**

Trend lines should only be quantitative in nature and based on actual statistical results. Trend line reliability is conveyed by its R-squared value or similar statistic. Any trend line display should note the R-square value on the graph or in the text. Qualitative or “illustrative” trend lines are not appropriate, can be misleading and should not be used in future reports. Trend lines should be presented only when their statistical derivation is described in the associated text. For example, the Panel was presented with a graph where a trend line was improperly inserted (see Slide 30, Turner, [August 24, 2020 presentation](#) to the Panel). The Panel notes that trend lines were appropriately inserted into other graphs (see Slide 19, Johnson, [August 24, 2020 presentation](#) to the Panel).

## 4.0: Panel’s Response to Petitioner Challenges

The Panel’s review was comprehensive and not limited to examining only the critiques provided by the Petitioners, but the Panel appreciates the clarity with which the Petitioners identified their concerns and proposed ideas for modifying the Program. In arriving at an overall assessment of the Program, the Panel carefully weighed the Petitioners’ critiques and proposals. While the Panel believes some of the Petitioners’ concerns will be addressed through implementation of the Panel’s recommendations (see Sections 3.2-3.5), the Panel believes that the Petitioners are seeking a fundamentally different monitoring program than the one that presently exists. The purpose of this chapter is for the Panel to respond to six main concerns that the Petitioners identified as their main critiques of the Program (Bothwell, [August 26, 2020 presentation](#) to the Panel).

### 4.1 Petitioner critiques about the Program’s monitoring design

Three of the six Program critiques identified by the Petitioners revolve around the Program’s monitoring design:

- **Petitioner Critique:** The sampling density is far too small to sufficiently detect exceedances
- **Petitioner Critique:** The monitoring plan does not adequately “track back” up the watershed to truly identify the source of the exceedance
- **Petitioner Critique:** Exceedances are not properly quantified because represented sites might not be in the same waterway

The Panel disagrees with these critiques and believes they reflect the Petitioners’ interpretation that the Program should be based on a different set of goals than those the Panel finds are specified in the General Order establishing the Program. The Petitioners stated that they prefer a larger number of sampling sites, and the ability to track upstream to specific sources, to achieve compliance at the individual farm level. Under the existing Program, when an exceedance is triggered, management plans are developed that include focused outreach to all growers within the watershed that could be responsible for an exceedance. While the Panel understands the Petitioners’ preference for a monitoring design that prioritizes holding individual growers accountable, the Panel does not support the Petitioner-suggested changes to the Program design, and concludes that the overall monitoring design should remain intact for the following three reasons.

**4.1.1: The Panel believes the intent of the Program – as articulated in the Order establishing the Program – is to achieve collective watershed-scale compliance, not individual grower compliance**  
In reaching a conclusion regarding the intended goals of the Program, the Panel examined the text establishing the Program, as well as statements made by the Regional Board during the Panel’s January 7-9, 2020 public meeting. Based on this review, the Panel concludes that the existing monitoring design – which emphasizes watershed-scale monitoring in support of collective grower compliance – is consistent with the Program’s goals.

The Panel focused on a number of specific passages in the Program’s establishing documents. In the Monitoring and Reporting Program (MRP) requirements for growers within the ESJ region (see

Attachment B of General Order R5-2012-0116-08), the first paragraph states: “The requirements of this MRP are necessary to monitor Member compliance with the provisions of the Order and determine whether state waters receiving discharges from Members are meeting water quality objectives.” Thus, an important consideration for the Panel in evaluating the Program’s monitoring design is whether the term “Member compliance” is intended to apply primarily to individual agricultural operations, or to all Members collectively at the watershed scale.

There are several references within the Order that indicate compliance should be monitored at the watershed scale. The General Provisions section of Attachment B describes how the Program conforms to the goals of the Non-point Source (NPS) Program as outlined in The Plan for California’s Nonpoint Source Pollution (NSP) Program. Of the five NPS program goals listed, the one relevant to compliance monitoring states that the Program should be “targeting NPS Program activities at the watershed level.” The Special Project Monitoring section states: “Special Project Monitoring studies will be designed to evaluate the effectiveness of practices used by multiple Members and will not be required of the third-party to evaluate compliance of an individual Member.”

The Order itself (Order R5-2012-0116-08) contains a section titled “Reason for the Central Valley Water Board Issuing this Order.” Under that heading, Finding 19, on page 5, states: “19. The rationale for developing general waste discharge requirements for irrigated agricultural lands in the Eastern San Joaquin River Watershed includes: (a) discharges are produced by similar operations (irrigated agriculture); (b) waste discharges under this Order involve similar types of wastes (wastes associated with farming); (c) water quality management practices are similar for irrigated agricultural operations; (d) due to the large number of operations and their contiguous location, these types of operations are more appropriately regulated under general rather than individual requirements; and (e) the geology and the climate are similar, which will tend to result in similar types of water quality problems and similar types of solutions.”

The Order addresses individual compliance in two sentences that both appear in Finding 23 (Pages 6 and 7) (underlined emphasis added by the Panel): “23. The surface water quality monitoring and trend groundwater quality monitoring under this Order are regional in nature instead of individual field discharge monitoring. The benefits of regional monitoring include the ability to determine whether water bodies accepting discharges from numerous irrigated lands are meeting water quality objectives and to determine whether practices, at the watershed level, are protective of water quality.”

This section continues: “However, there are limitations to regional monitoring’s effectiveness in determining possible sources of water quality problems, the effectiveness of management practices, and individual compliance with this Order’s requirements.

“Therefore, through the reporting and evaluation of applied nitrogen versus removed nitrogen, the Management Practices Evaluation Program, development and utilization of Groundwater Protection Targets, the Surface Water Quality Management Plans and Groundwater Quality Management Plans, the third-party must evaluate the effectiveness of management practices in protecting water quality. In

addition, Members must report the practices they are implementing to protect water quality and comply with Surface and Groundwater Quality Management Plans as applicable. Through the evaluations and studies conducted by the third-party, the reporting of applied and removed nitrogen as well as the management practices used by the Members, and the board's compliance and enforcement activities, the board will be able to determine whether a Member is complying with the Order.

“Where required monitoring and evaluation does not allow the Central Valley Water Board to determine potential sources of water quality problems or identify whether management practices are effective, this Order requires the third-party to provide technical reports at the direction of the Executive Officer. Such technical reports are needed when monitoring or other available information is not sufficient to determine the effects of irrigated agricultural waste discharges to state waters. It may also be necessary for the board to conduct investigations by obtaining information directly from Members to assess individual compliance.”

The Panel has determined that the emphasized text cited above clearly differentiates between the use of monitoring to evaluate water quality at the watershed level vs. the use of other means at the Regional Board's disposal to assess individual sources and compliance, including reporting, management practice evaluation, special studies, and board investigations conducted by obtaining information directly from Members.

#### **4.1.2: The ESJ's limited hydrologic connectivity – in combination with the region's soils and pesticide application practices – constrain options for alternative monitoring designs**

Many watershed monitoring programs are characterized by linear sampling strategies, where sampling sites are aligned from upstream to downstream to follow the flow of water. The Panel recognizes that a tributary-based design is often appropriate, as it enables exceedances to be “tracked back” to their upstream source. But in the ESJ region, a linear sampling design would be impractical.

Source tracking depends on being able to move upstream in a watershed to track an exceedance to its origin. However, the ESJ region's hydrologic connectivity is limited. Many waterways run dry except during intense, infrequent wet-weather events, and the ESJ region's soils infiltrate water effectively, limiting runoff during both wet and dry weather. While there are a limited number of days per year – particularly following extended rainfall events – when there is widespread hydrological connectivity, the Panel feels that it is infeasible to design a year-round program around these infrequent events, which are logistically difficult to predict and comprehensively measure.

Expanding the number of sampling sites also would be impractical. The system of water supply and drainage channels in the area has been heavily modified for over a century and bears little resemblance to a natural stream network that has relatively predictable tributary flow patterns. Major rivers, which are a high priority for habitat protection, are deliberately excluded from the monitoring design because the sources of pollutants to these rivers could be located well beyond the ESJ region. The number of potential suitable sampling sites is further limited by site access issues and the location of the site relative to non-agricultural pollution sources that can confound results. As a result, there is limited

availability of potential sampling sites that meet the necessary selection criteria. The Panel is convinced that the Coalition and its consultants have already done extensive mapping and field reconnaissance just to find the existing set of suitable sites.

Pesticide-use practices in the ESJ region further constrain the utility of alternative options for monitoring design. Aerial pesticide applications by ground-based farm equipment appear to be the dominant pathway by which pesticides are transported to ESJ surface waters. These transport events, however, are of limited duration and occur less continually than field runoff from irrigated lands in other regions. Thus, pesticide runoff from these events is likely to consist of sporadic pulses, not continuous sources of contamination that can be readily tracked through a linear sampling design.

The Panel believes the existing represented watershed approach is an appropriate monitoring design. The Panel is not convinced that different or additional sampling sites in the ESJ region would result in the identification of additional exceeding constituents or different trends in constituent concentrations over time, especially given the lack of hydrological connection for most of the year between downstream sites and most upstream sites. Furthermore, the Panel does not believe that a reasonable expansion of the Program's existing sampling network would measurably change the Program's effectiveness in identifying exceedances – again, given the ESJ region's complex, engineered channel network, intermittent flows, short duration of spray drift transport, and paucity of field runoff events.

Because of the practical constraints unique to the ESJ region, the Panel does not support prioritizing source tracking to individual growers in the Program's monitoring design. The Panel believes the Program's resources are more efficiently allocated to focused outreach that targets all growers in a watershed that could be responsible for an exceedance. In other words, the Panel supports the Program's existing approach to eliminating exceedances through monitoring, outreach and behavior change – as opposed to tracking, policing and enforcement. The Panel believes that this focused outreach is promoting farm-specific best management practices among a wider swath of growers than if the Program targeted individual growers found to be responsible for exceedances. An added benefit is that the broader audience for watershed-scale outreach also tends to boost compliance through peer pressure to adhere to grower best management practices.

While the Panel does not support prioritizing source tracking in the monitoring design, the Panel notes that the Regional Board has, at its discretion, the ability to compel special source tracking studies where appropriate. Thus, the Panel believes the existing Program enables all growers that could be responsible for an exceedance to be targeted for focused outreach, while simultaneously allowing for special source tracking studies that can shed additional insights into grower-specific management practices.

#### **4.1.3: The existing Program has an established track record**

The existing Program has routinely led to identification of exceedances and the completion of management plans for responding to those exceedances, suggesting that the Program has been effective in improving receiving water quality. For pesticides that are found to exceed water quality objectives, the Panel has identified 24 management plans for pesticide exceedances and toxicity that have been completed. The Panel cannot rule out that some of these improvements result from changes

in the types of pesticides applied over time, but the Panel believes there is strong evidence that management actions resulting from Program data has led to receiving water quality improvements.

#### 4.2 Petitioner critique: Monitoring procedures do not sample the sensitive species necessary to detect changing pesticide use

The Panel agrees with this Petitioner critique that the existing Program is unable to detect key pesticides and thus could be missing critical exceedances. Consequently, the Panel has developed a set of recommendations (see Section 3.2) to modify the Program and ensure the Program is adequately and consistently considering changing pesticide use in the ESJ region. The Panel is not only recommending short-term addition of *Chironomus sp.* toxicity testing to provide more sensitivity to neonicotinoids and similar current-use pesticides (see Recommendation 3.2.1), but the Panel also is recommending long-term changes that will introduce more rigor and consistency to how the Program selects toxicity tests and analyzes associated chemistry samples going forward (see Recommendations 3.2.2 and 3.2.3).

#### 4.3 Petitioner critique: Addressing the exceedance is not done in a timely manner, and will not result in meaningful changes to best management practices

The Panel heard the Petitioners identify three main ways that exceedances are not addressed in a timely manner: (1) The data are not made available quickly enough to spur management action, (2) the data are not acted on quickly by the Coalition and the Regional Board once made available, and (3) the data are not made available to the Petitioners rapidly enough for them to engage in the adaptive management process. The Panel does not share the Petitioners' concerns about timeliness issues.

First, many of the laboratory analyses being performed are sophisticated and take considerable processing time, including quality assurance activities. The Panel saw no evidence that these activities were taking longer to produce than for any typical laboratory. The Panel observed that the Program is well-implemented with an effective data management system, with no substantive delay with transitioning data from the laboratory to the data management system, or in retrieving the data from the management system.

Second, the Petitioners asserted that the growers get to look at and consider the data before the data are provided to the Regional Board and to the Petitioners. The Panel believes this practice is appropriate, as the entity responsible for producing the data should have the opportunity to interact with their contractor to ensure the data are correct before they are submitted. The Panel also does not believe this data review step takes an unacceptably large amount of time, and instead saw evidence that the public had reasonably timely access to the data.

Third, the Panel observed that the Coalition meets with the Regional Board annually to plan how the Program will evolve based on the data for that year, which the Panel believes is appropriate to the scale of the Program. Early on in the Program's development, the Coalition acknowledged delays in the development and implementation of management plans after an exceedance was identified. But the Program has improved on this timing issue, and more recently has been sending out notices prior to the development of full management plans to alert growers to potential problems. The Panel believes that at the heart of the Petitioners' critique about timeliness is the Petitioners' preference for a Program that

emphasizes enforcement at the individual farm level (i.e., enforcement at the same time the samples are collected). Again, the Panel does not feel this is the purpose of the Program (see Section 4.1.1), nor is the episodic nature of the flow and inputs conducive to using the data in this way (see Section 4.1.2).

#### 4.4 Petitioner critique: The Coalition is not addressing the most critical exceedances

The Panel disagrees with the Petitioners' assertion that critical exceedances, once identified, are not being addressed. The Program has enabled numerous exceedances to be addressed; indeed, there are multiple examples that the Panel believes indicate the Program has been successful in developing management plans and conducting focused outreach to address exceedances. To date, 24 management plans for pesticide exceedances and toxicity have been completed. That said, the Panel emphasizes two important caveats: (1) The Program cannot address critical exceedances that haven't been identified, and the Panel finds that the existing Program falls short of characterizing concentrations and biological effects of some current-use pesticides (see Key Finding 3.2), which could be constraining the Program's ability to identify all critical exceedances, and (2) the Program does not adequately and comprehensively address persistent low dissolved oxygen levels in waterways in the ESJ region; the Panel has developed a multi-pronged set of recommendations to address this shortcoming (see Key Finding 3.3).

## 5.0 Appendices

### 5.1 Answers to Panel charge questions

The Panel made a conscious decision to organize its report around key findings and recommendations, which the Panel believes is the most effective structure for conveying the Panel’s most important conclusions. At the same time, the Panel remained focused throughout the review process on the charge questions provided to the Panel. Thus, while the answers to these charge questions are embedded throughout the body of the report, the Panel decided to briefly answer each charge question in the report’s appendix, with pointers to full Panel explanations and rationale elsewhere in the report.

**Charge Question 1:** Is there a clear linkage between the six surface water monitoring program questions and the decisions that will be made by the Central Valley Water Board, the ESJWQC, and the ESJWQC’s members?

Yes, the Panel saw numerous examples illustrating the Program’s success using data from the Program to inform management decision-making and action. In particular, the Panel notes that 24 management plans for pesticide exceedances and toxicity have been completed, indicating that multiple critical water-quality impairments have been addressed through the Program (see Section 4.4).

**Charge Question 2:** Is the ESJ monitoring framework appropriate to answer the ILRP’s questions?

Yes, the Panel finds that the existing monitoring design is appropriate (see Key Finding 3.1). The Panel considered the alternative design proposed by the Petitioners, but concludes that the alternative design addresses a different management question – one that prioritizes assessing performance of individual growers instead of focusing on watershed-scale compliance. The Panel finds the existing monitoring design is a preferred, superior approach for multiple reasons (see Section 4.1).

- **Subquestion 2a:** Is the monitoring program design, including the reliance on use of core and represented sites, a technically sound approach?

Yes, the Panel supports the existing monitoring design (see Key Finding 3.1), except as modified by the Panel’s recommendations on selected measurement types (see Key Findings 3.2 through 3.5).

- **Subquestion 2b:** Are the criteria presently being used to select represented sites appropriate?

Yes, the ESJ region is constrained by limited availability of potential sampling sites that meet the necessary selection criteria (see Section 4.1.2). The Panel would prefer that sediment sampling sites all be located in depositional areas, but the Panel believes that the Coalition and its consultants have conducted appropriate field surveys in an effort to find more appropriate nearby sites. In the spirit of continuous improvement, the Panel suggests that the Coalition revisit its search for more appropriate depositional sites, but on the whole the Panel is comfortable with the existing site selection criteria.



- **Subquestion 2c:** Are the monitoring sites of sufficient spatial density to identify general locations of potential pollution resulting from irrigated agricultural waste discharges?

Yes, the Panel supports the overall monitoring design (see Key Finding 3.1). The Panel believes that altering the design to include a larger number of sampling sites would only be needed if the Program were addressing a different monitoring goal – one that prioritizes farm-specific compliance, rather than regional compliance (see Section 4.2).

- **Subquestion 2d:** Are the monitoring sites of sufficient temporal intensity to identify potential trends in pollution resulting from irrigated agricultural waste discharges?

Yes, with two minor exceptions. First, sampling for dissolved oxygen is conducted at inappropriate times of day (see Section 3.3). Second, the Panel believes temporal density and timing should be continuously revisited. The Panel has recommended adding additional steps to the Pesticides Evaluation Protocol (PEP), including Step 10, which calls on the Program to revisit the timing of sampling activities each year based on which pesticides are selected for monitoring (see Recommendation 3.2.3).

- **Subquestion 2e:** Are the monitoring parameters and measurement methods suitable to address the six ILRP monitoring questions?

Yes, except as noted by the Panel in Key Findings 3.2-3.5. The Panel concludes that the Program's monitoring parameters and measurement methods are, as a whole, appropriate for addressing the ILRP questions (see Key Finding 3.1), and recommends changes to strengthen the existing Program (see Key Findings 3.2-3.5), including improvements to how current-use pesticides are monitored and how dissolved oxygen is measured.

**Charge Question 3:** Is there a mutual understanding of how the monitoring data are going to be used by the Central Valley Water Board and the ESJWQC, individually and collectively?

Yes, the Panel saw strong evidence of a clear, shared understanding between the Regional Board and Coalition in how monitoring data will be used. However, the Panel also recognizes that the Petitioners do not share these perceptions. Thus, the Panel suggests adding more opportunities for public participation to help make this productive working relationship more readily apparent.

- **Subquestion 3a:** Are the data submission requirements appropriate?

Yes, the Panel reviewed the data submission requirements and found that they are appropriate (see Key Finding 3.5).

- **Subquestion 3b:** Are the data integration approaches, and thresholds for assessment, appropriate?

Yes, except as noted by the Panel in Key Findings 3.2-3.5. In particular, the Panel has identified multiple specific recommendations for improving how Program data are presented (see Key Finding 3.5).

- **Subquestion 3c:** Is the translation process from data into potential actions clear, including the possible triggering of enhanced monitoring for source attribution or enhanced spatial/temporal pattern description?

Yes, the Panel finds that the Program uses an appropriate monitoring design that prioritizes watershed-scale compliance (see Key Finding 3.1). The Panel also finds that the Coalition and Regional Board routinely work together to develop additional studies, including source tracking and other follow-on studies that supplement data generated through the core monitoring program (see Section 4.1). The Program has successfully completed 24 management plans for pesticide exceedances and toxicity, providing compelling evidence that monitoring data are being consistently translated to management action.

- **Subquestion 3d:** What iterative processes for evaluating monitoring program effectiveness could be implemented for continuous improvement?

The Panel believes the Program has strong iterative processes in place, but has identified ways to enhance them. The Panel concludes that the Program's Pesticides Evaluation Protocol (PEP) is appropriate, but recommends expanding the PEP to encompass other key decisions being made by the Program in the development of pesticide monitoring plans (see Recommendation 3.2.3). The expanded PEP will introduce additional iterative processes that enhance the Program's commitment to continuous improvement.

**Charge Question 4:** If revisions to the program are recommended, are there steps that should be taken to incorporate compatibility with historic information?

For the most part, no further action is needed. The Panel recommends multiple specific revisions to the design and implementation of the Program (see Key Findings 3.2-3.5), but none of these Program revisions would require the Program to take additional steps to create compatibility with historical data. In particular, the Panel does not recommend changing the locations of sampling sites. Instead, the Panel recommends adding a *Chironomus* toxicity test (see Recommendation 3.2.1), which would provide new, more insightful data but would not interfere with historical trend lines. The Panel also recommends improving the Program's approach to measuring and analyzing dissolved oxygen, including potentially re-analyzing historical data (see Recommendation 3.3.1). This reanalysis, informed by a better understanding of diurnal temporal patterns, will enhance the value of historical comparisons.

## 5.2 Biographies of Panelists



**Dr. Kevin Armbrust**

Kevin is Chair of the Environmental Sciences Department at Louisiana State University. Previously, Kevin was Director of the Mississippi State Chemical Laboratory and an Associate Professor at Mississippi State University. [Full resume](#)



**Mr. Jon Costantino**

Jon is Principal of Tradesman Advisors, a regulatory consultancy firm. Previously, Jon was the Climate Change Planning Manager for the California Air Resources Board, overseeing publication of the State's economy-wide climate policy document, and served two terms on the Central Valley Regional Water Quality Control Board. [Full resume](#)



**Dr. John Hunt**

John is a Research Toxicologist at UC Davis and has designed and advised statewide and regional water quality monitoring programs under the auspices of the California Surface Water Ambient Monitoring Program. He served for 20 years as Director of the Marine Pollution Studies Laboratory at Granite Canyon. [Full resume](#)



**Dr. Charles Menzie**

Charles is Global Executive Director for the Society of Environmental Toxicology and Chemistry, where he oversees global initiatives and activities of the society. He also maintains a private consulting practice on risk assessment, in which he has testified as an expert before the International Court of Justice and the U.S. Supreme Court. [Full resume](#)



**Dr. Doug Parker**

Doug is Director of the California Institute for Water Resources, UC Agriculture and Natural Resources, where he coordinates water-related research, extension, and education efforts across ten UC campuses. Prior to joining the University of California, Doug worked on water quality issues related to the Chesapeake Bay as a Professor and Extension Specialist in the Department of Agricultural and Resource Economics at the University of Maryland. [Full resume](#)

### 5.3 Meeting agendas

The meeting agendas for all three public Panel meetings appear on the pages that follow.

## **East San Joaquin (ESJ) Surface Water Quality Monitoring Program Review Panel**

### **January 7-9, 2020 Meeting agenda**

To be held at:  
Central Valley Regional Water Quality Control Board  
11020 Sun Center Drive, #200  
Rancho Cordova, CA 95670-6114

Meeting will be webcast (go to: <https://video.calepa.ca.gov>)

#### **Tuesday, Jan 7 (Open to the public)**

All presentations will be for half of the allotted time. The remaining time will be allocated first for questions from the Review Panel and then for public comment regarding that item, to the extent time remains after Panel member questions. Dedicated time for any aspect of public comment will be available at 4:10.

8:30	Coffee & pastries	
9:00	Welcome and introductions	Steve Weisberg SCCWRP
9:10	Program overview and history of the General Order	Sue McConnell CVRWQCB
9:40	Purpose of the review	Patrick Pulupa CVRWQCB
9:50	Panel charge questions	Steve Weisberg SCCWRP
10:10	Break	
10:30	Monitoring program sampling framework	Michael Johnson MLJ Environmental

11:10 Field collection and laboratory measurement methods  
Melissa Turner  
MLJ Environmental

11:45 Data management  
Melissa Turner  
MLJ Environmental

12:15 Lunch (provided on site for \$20)

**Previous technical reviews of the program**

1:00 Monterey Coastkeeper review of the program  
Coastkeeper  
Steve Shimek  
Monterey

1:40 ESJWQC Review of the Program  
Dr. Susan Paulsen  
Exponent

2:20 Break

**Stakeholder Perspectives about how they would like to see the program change (or not)**

2:40 Perspective from the Regional Board  
Patrick Pulupa  
CVRWQCB

3:10 Perspective from the environmental community (petitioners)  
Sean Bothwell  
Coastkeeper Alliance

3:40 Perspective from the Coalition  
Michael Johnson  
MLJ Environmental

4:10 Public comments

5:30 Adjourn for the day

6:00 Panel member dinner

**Wednesday, January 8**

**Expert Panel field trip** (Public welcome at each stop – all times approximate)

7:00 Depart Rancho Cordova  
9:00 Rest stop (Starbucks, 2952 Speno Drive, Patterson)  
9:45 Stop 1: San Joaquin River at Hills Ferry (TMDL)  
10:10 Stop 2: Unnamed Drain @ Hwy 140 (Rep)  
10:35 Stop 3: Howard Lateral @ Hwy 140 (Rep)  
10:45 Stop 4: Livingston Drain @ Robin Ave. (Rep)

- 11:10 Rest stop (ampm, 1615 Bell Lane, Atwater)
- 11:50 Stop 5: Bear Creek @ Kibby Rd (Rep)
- 12:50 Lunch (Merced County Farm Bureau)
- 2:05 Stop 6: Canal Creek @ West Bellevue Rd. (Core)
- 2:30 Stop 7: Merced River @ Oakdale Rd. (Core)
- 5:00 Arrive Rancho Cordova
  
- 6:00 Dinner (Panel members only)

**Thursday, January 9**

- 8:00 Panel deliberations (Panel members only)

**Panel Report Out (Open to the public)**

- 3:00 Panel’s initial impressions and approach to deliberations Panel Chair
- 3:30 Public comments and questions for the Panel
- 4:45 Summary of process and future meeting dates Steve Weisberg  
SCCWRP
- 5:00 Adjourn

## Second meeting of the East San Joaquin (ESJ) Surface Water Quality Monitoring Program Review Panel

**August 24-26, 2020**  
**Meeting agenda**

This is a remote meeting. Please register here to attend:

[https://us02web.zoom.us/webinar/register/WN\\_4ZNqVGIyTS68c1yVrTq9eA](https://us02web.zoom.us/webinar/register/WN_4ZNqVGIyTS68c1yVrTq9eA)

All presentations will be for half of the allotted time. The remaining time will be for questions from the Review Panel and then for public comment regarding that item, to the extent time remains after Panel member questions. Dedicated time for additional public comment will be available at the end of each day.

### **Monday, August 24**

- |       |   |                                     |
|-------|---|-------------------------------------|
| 8:30  | Meeting goals and online meeting procedures   | Steve Weisberg<br>SCCWRP            |
| 8:40  | Case studies illustrating program effectiveness   | Melissa Turner<br>MLJ Environmental |
| 9:40  | Case studies illustrating how “special studies are used to help develop managements plans | Mike Johnson<br>MLJ Environmental   |
| 10:40 | System hydrology  | Parry Klassen<br>ESJ Coalition      |
| 11:10 | Public comments   |                                     |
| 12:00 | Lunch break   |                                     |
| 1:00  | Panel deliberations (Panel members only)  |                                     |
| 3:00  | Adjourn for the day   |                                     |

### **Tuesday, August 25**

- |      |   |   |
|------|---|---|
| 8:30 | Meeting goals and online meeting procedures | Steve Weisberg<br>SCCWRP                |
| 8:40 | Toxicity testing alternatives               | Steve Shimek<br>Monterey<br>Coastkeeper |

- 9:30 Ventura County agricultural monitoring program  
Snejana Toneva/Jun Zhu  
Los Angeles Regional  
Water Board  
and  
Amy Storm  
Larry Walker and  
Associates
- 10:20 Delta Regional Monitoring Program and  
assessment of downstream effects  
Selina Cole/Adam Laputz  
Central Valley  
Regional Water Board
- 11:10 Public comments
- 12:00 Lunch break
- 1:00 Panel deliberations (Panel members only)
- 3:00 Adjourn for the day

**Wednesday, August 26**

- 8:30 Meeting goals and online meeting procedures  
Steve Weisberg  
SCCWRP
- 8:40 Additional perspectives from the environmental  
community (petitioners)  
Sean Bothwell  
Coastkeeper Alliance
- 9:00 Additional perspectives from the ESJ Coalition  
Parry Klassen  
ESJ Coalition
- 9:20 Public comments
- 10:00 Panel deliberations (Panel members only)
- 1:30 Panel report out on their findings  
John Hunt  
Panel Chair
- 2:00 Public comments and questions for the Panel
- 2:45 Summary of process and future meeting dates  
Steve Weisberg  
SCCWRP
- 3:00 Adjourn