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SACRAMENTO VALLEY WATER QUALITY COALITION

Monitoring and Reporting Program Annual Monitoring Report 2021: October 2020 – September 2021

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science | policy | solutions

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Executive Summary

SUMMARY OF MONITORING PROGRAM

The Sacramento Valley Water Quality Coalition (Coalition) has developed and implemented a Monitoring and Reporting Program (MRP) to meet the requirements of the *Waste Discharge Requirements General Order for Growers within the Sacramento River Watershed that are Members of a Third-Party Group* (*R5-2014-0030, most recently amended by Order No. R5-2021-0053*) (WDR).[1] The scope of the MRP and the sampling and analytical methods used in the Coalition's 2021 Monitoring Year (October 2020 – September 2021) were approved by the Central Valley Regional Water Quality Control Board (Central Valley Water Board).

In accordance with the WDR requirements, the Coalition is achieving these objectives by implementing a MRP that evaluates samples for the presence of statistically significant toxicity and exceedances of applicable numeric water quality objectives and Irrigated Lands Regulatory Program (ILRP) Trigger Limits. The Coalition initiates follow-up actions designed to identify constituents causing significant toxicity when toxicity is of sufficient magnitude. Exceedances of numeric objectives and ILRP Trigger Limits for chemical, physical, and microbiological parameters trigger follow-up actions designed to identify potential sources and to inform potential users of the products that contain constituents of concern. Additionally, the Coalition is evaluating the degree of implementation of current management practices in priority drainages and represented drainages (i.e., those where Management Plans have been triggered) and recommending additional practices as water quality results indicate a need to do so. The Coalition is committed to the principle of adaptive management to control specific discharges of waste from agricultural lands that are having an impact on water quality. This iterative approach allows for the most effective use of limited human and fiscal resources.

Surface water quality and sediment sampling for the Coalition's 2021 Monitoring Year was conducted in coordination with the following subwatershed monitoring programs: Northeastern California Water Association (NECWA), Placer-Nevada-South Sutter-North Sacramento (PNSSNS), Goose Lake, Upper Feather River (UFRW), Lake County, and Napa County. The parameters monitored in 2021 by the Coalition to achieve these objectives are as specified in the current WDR and MRP (*Order No. R5-2014-0030*):

- Water column and sediment toxicity
- Physical and conventional parameters in water
- Organic carbon
- Pathogen indicator organisms in water
- Trace metals in water

[1] The WDR was initially adopted in 2014 (R5-2014-0030) but was later revised to its current version in October 2021. Prior to adoption of the WDR, the Coalition was subject to a Conditional Waiver of Waste Discharge Requirements for the Irrigated Lands Regulatory Program (ILRP) and subsequent amendments to the ILRP requirements (WQO-2004-0003, SWRCB 2004, R5-2005-0833, R5-2008-0005, R5-2009-0875).

- Pesticides in water
- Nitrogen and phosphorus compounds in water

The current WDR and MRP also require testing for 303(d)-listed constituents identified in water bodies downstream from Coalition sites and discharged within the watershed if irrigated agriculture has been identified as a contributing source within the Sacramento River Watershed and such monitoring has been requested by the Central Valley Water Board's Executive Officer.

The Central Valley Water Board's *Amendment to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins for the Control of Pyrethroid Pesticide Discharges* (Pyrethroid Pesticide Basin Plan Amendment (BPA); Resolution R5-2017-0057[2]) required that the 2021 Monitoring Year include pyrethroid pesticides baseline monitoring at the Coalition's representative sites. The pyrethroid pesticides baseline monitoring required additional water column pyrethroid pesticide analyses and *Hyalella azteca* toxicity testing in both water column and sediment samples.

Note that not all parameters are monitored at every site for every monitoring event. Specific individual parameters measured by the Coalition during the 2021 Monitoring Year are listed in **Table 2**. A total of 22 sites were monitored by the Coalition and coordinating subwatershed monitoring programs during 2021 Monitoring Year (**Table 3**). A map of these sites is presented in **Figure 1**. As required by the MRP, Coalition monitoring events include storm season monitoring and irrigation season monitoring. The sites and numbers of samples scheduled for collection during 2021 Coalition Monitoring are summarized in **Table 4**. This *2021 Annual Monitoring Report* (AMR) includes results for October 2020 through September 2021.

Sample collection and analysis during the 2021 Monitoring Year were performed by the following agencies and subcontractors.

- Pacific EcoRisk (Fairfield, California) performed toxicity testing and conducted sampling for all sites, with the specific exceptions noted below:
    - Placer County Resource Conservation District conducted sampling on behalf of the PNSSNS Watershed Group for the PNSSNS subwatershed site;
    - Vestra Environmental conducted sampling on behalf of NECWA for the Pit River subwatershed site;
    - UFRW Group conducted sampling for the UFRW subwatershed site;
    - Modoc Resource Conservation District conducted sampling on behalf of the Goose Lake Subwatershed Group for the Goose Lake subwatershed site; and
    - Clear Lake Environmental Research Center Lab (CLERCL) conducted sampling on behalf of the Lake and Napa Subwatershed Groups for the monitoring sites within the Lake and Napa subwatersheds.

[2] Central Valley Regional Water Quality Control Board. *Amendment to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins for the Control of Pyrethroid Pesticide Discharges.* Resolution R5-2017-0057. Adopted on June 8, 2017. https://www.waterboards.ca.gov/rwqcb5/board_decisions/adopted_orders/resolutions/r5-2017-0057_res.pdf

- Caltest Analytical Laboratory (Napa, California) conducted conventional, nutrient, microbiological, and pyrethroid pesticide analyses.
- Agriculture & Priority Pollutant Laboratories, Inc. (APPL) (Clovis, California) conducted pesticide analyses.
- North Coast Laboratories (Arcata, CA) conducted pesticide analyses.
- PHYSIS Environmental Lab (Anaheim, CA) conducted pesticide analyses.
- Basic Laboratory (Redding, CA) conducted conventional, nutrient, and microbiological analyses for the Goose Lake, Pit River, and UFRW subwatershed sites.
- CLERCL (Lakeport, CA) conducted bacteria analyses for the Lake and Napa subwatershed sites.

TREND ANALYSIS

The Coalition's 2021 Monitoring Plan Update[3] was approved by Central Valley Water Board staff as meeting the requirements of the WDR, MPR, and Pesticides Evaluation Protocol. The WDR provides no additional guidance or criteria for making a determination that there are "deficiencies in monitoring" or that additional monitoring locations or events are needed, and none were identified as a result of the trend analysis conducted for this report. The results of the trend analyses conducted for this AMR did not indicate a need for monitoring any additional locations, events, or parameters during a future monitoring year. The adoption of the Pesticides Evaluation Protocol has already expanded the number of parameters that the Coalition analyzes. We recommend that the modified trend analysis no longer be performed during non-assessment years and that the full trend analysis approach be performed following the completion of the single assessment year monitoring[4] that was approved by the Central Valley Water Board beginning with the 2023 Monitoring Year. A three-year cycle for the Coalition's trend analysis would increase the current frequency at which the Coalition's monitoring data are evaluated for potential water quality degradation at Coalition monitoring sites.

MANAGEMENT PRACTICES AND ACTIONS TAKEN

Response to Exceedances

To address specific water quality exceedances, the Coalition and its partners developed a Management Plan in 2009, subsequently approved by the Central Valley Water Board. The Coalition also previously developed a *Landowner Outreach and Management Practices Implementation Communications Process for Monitoring Results (Management Practices*

[3] On August 1 of each year, the Coalition is required to submit to the Central Valley Water Board an updated monitoring plan for the upcoming monitoring year (October through September). This annual monitoring plan is called the Monitoring Plan Update, and for 2021 it was developed to follow the requirements of the 2014 WDR and MRP, the Central Valley Water Board's 2016 Pesticides Evaluation Protocol, and the Pyrethroid Pesticide BPA.

[4] The Sacramento Valley Water Quality Coalition was approved by the Central Valley Water Board for a 3-year cycle of Assessment-Core-Core monitoring on 14 February 2022. The revised monitoring schedule will begin in October 2021 (2022 Monitoring Year), an assessment year, with core monitoring following during the 2023 Monitoring Year (October 2022 – September 2023) and 2024 Monitoring Year (October 2023 – September 2024).

Process) to address exceedances. The 2009 Management Plan was reorganized into the Comprehensive Surface Water Quality Management Plan (CSQMP) in 2015. The CSQMP was last updated in September 2016 and approved by the Central Valley Water Board in November 2016. Site-specific Management Plans are included as addenda to the CSQMP as they are developed by the Coalition and approved by the Central Valley Water Board. Implementation of the approved 2016 CSQMP is the primary mechanism for addressing exceedances observed in the Coalition's surface water monitoring.

Management Plan Status Update

The Coalition's Management Plan Progress Report (MPPR), a document that describes the status and progress toward meeting individual Management Plan element requirements for 2021, is provided to the Central Valley Water Board with this Annual Monitoring Report. Activities conducted in 2021 to implement the Coalition's CSQMP included addressing exceedances of objectives for registered pesticides, toxicity, and nutrients, in addition to conducting monitoring required for existing toxicity and pesticide Management Plans and Total Maximum Daily Loads (TMDLs).

Implementation completed specifically for registered pesticides and toxicity included review and evaluation of pesticide application data, identification of potential sources, and determination of likely agricultural sources. Prior to 2015, surveys of Coalition members operating on high priority parcels were conducted to determine the degree of implementation of relevant management practices related to individual Management Plan elements for registered pesticides and identified causes of toxicity. Beginning in 2015, these surveys were replaced with data compiled from Coalition Member Farm Evaluations, which are currently collected on a five-year cycle with the most recent survey conducted for the 2020 crop year. During the period 2017 through 2019, select Coalition Subwatersheds conducted Focused Outreach Surveys with growers who operate within the area covered by an active Management Plan for a registered pesticide and/or toxicity and who applied the registered pesticide identified in the Management Plan. The use of Focused Outreach Surveys ended when the Coalition was required to complete Management Plan Implementation Reports (MPIR) beginning with the 2020 crop year. The MPIR is used to report management practices implemented by Coalition members to comply with requirements under a Surface Water Quality Management Plan. The Coalition's Focused Outreach and MPIR survey data have been used to establish goals for additional management practice implementation needed to address exceedances of Basin Plan water quality objectives and ILRP Trigger Limits.

CONCLUSIONS AND RECOMMENDATIONS

The Coalition submits this *2021 Annual Monitoring Report* as required under the Central Valley Water Board's Irrigated Lands Regulatory Program. The AMR provides a detailed description of the Coalition's monitoring results as part of its ongoing efforts to characterize water quality impacts from irrigated agricultural and wetlands operations in the Sacramento River Basin.

To summarize, the results from the Coalition's monitoring conducted during the 2021 Monitoring Year continue to indicate that with few exceptions, there are no major water quality problems as a result of discharges from agricultural lands and managed wetlands in the Sacramento River Basin.

This AMR characterizes potential water quality impacts of agricultural drainage from a broad geographic area in the Sacramento Valley from October 2020 through September 2021. To date, a total of 185 Coalition storm and irrigation season events have been completed since the beginning of Coalition monitoring in January 2005, with additional events collected by coordinating programs and for follow-up evaluations. For the period of record considered in this AMR (October 2020 through September 2021), samples were collected for nine scheduled monthly events and two wet weather ("storm") events.

Pesticides were infrequently detected (~7.0% of all pesticide results generated during the 2021 Monitoring Year were for detected concentrations), and when detected, rarely exceeded applicable objectives. Many of the pesticides specifically required to be monitored in the past by the ILRP have rarely been detected in Coalition water samples. Over 98.1% of all pesticide analyses performed to date for the Coalition have been below detection. Coalition monitoring of pesticides for the ILRP during the 2021 Monitoring Year was conducted based on the 2016 Pesticides Evaluation Protocol (PEP) and active Management Plan element requirements. The Central Valley Water Board's PEP requires the Coalition to monitor specific registered pesticides based on (1) their rate of application in a given drainage (lb. applied per drainage) and (2) a pesticide-specific relative risk (the ratio of the amount of chemical applied to a reference value for the protection of aquatic life or human health, with a specific averaging period). The Coalition also conducted monitoring of the ILRP-required trace elements (arsenic, boron, copper, and zinc) informed by the Coalition's past monitoring results, which have demonstrated that most of these metals rarely approach or exceed objectives and are not likely to cause adverse impacts to aquatic life or human health in waters receiving agricultural runoff in the Sacramento River Watershed. This strategy for monitoring trace metals was implemented in 2010 in accordance with the Coalition's 2009 MRP (*Order No. R5-2009-0875*, CVRWQCB 2009), and this same strategy is consistent with the requirements of the current WDR and MRP (*Order No. R5-2014-0030*).

The majority of exceedances of adopted numeric objectives continue to consist of specific conductivity, dissolved oxygen, pH, and *E. coli*. Agricultural runoff and irrigation return flows may contribute to exceedances of these objectives, but these parameters are primarily controlled or significantly affected by natural processes and sources that are not controllable by agricultural management practices.

The Coalition has implemented the requirements of the ILRP since 2004. The Coalition developed a Watershed Evaluation Report (WER) that set the priorities for the development and implementation of the initial Monitoring and Reporting Program Plan (MRPP). The Coalition successfully developed the MRPP, Quality Assurance Project Plan (QAPP), and Management Plan as required by the ILRP, and all were approved by the Central Valley Water Board. Subsequent revisions requested by the Central Valley Water Board and the Coalition were incorporated into the Coalition's program and implemented through the Coalition's ongoing monitoring efforts. The Coalition also continues to adapt and improve elements of its monitoring program based on the knowledge gained through its ongoing monitoring efforts.

The Coalition's 2021 monitoring program, as specified in the 2021 Monitoring Plan Update, was developed to be consistent with the requirements of the WDR and MRP (*Order No. R5-2014-0030*) and 2016 PEP, and was approved by the Central Valley Water Board for this purpose with the understanding that the 2021 Monitoring Year would serve as a "non-Assessment" (i.e.,

"Core") monitoring period for the Coalition, but with additional pyrethroid pesticide baseline monitoring as required by the Pyrethroid Pesticide BPA. The Coalition has implemented the approved monitoring program in coordination with its subwatershed partners, has initiated follow-up activities required to address observed exceedances, and continued to implement the approved 2016 CSQMP and approved individual Management Plan elements. Throughout this process, the Coalition has kept an open line of communication with the Central Valley Water Board and has made every effort to fulfill the requirements of the ILRP in a cost-effective, scientifically defensible, and management-focused manner. This AMR is documentation of the success and continued progress of the Coalition in achieving these objectives.

Introduction

The primary purpose of this report is to document the monitoring efforts and results of the Sacramento Valley Water Quality Coalition (Coalition) Monitoring and Reporting Program (MRP). This Annual Monitoring Report (AMR) for the 2021 Monitoring Year also serves to document the Coalition's progress toward fulfilling the requirements of its *Waste Discharge Requirements General Order for Growers within the Sacramento River Watershed that are Members of a Third-Party Group* (*R5-2014-0030*) (WDR).[5]

The AMR includes the following elements noted in **Table 1**, as specified in the WDR's MRP:

Table 1. MRP Annual Monitoring Report Requirements[6]

MRP Section	AMR Requirement	Report Section Headings	Page
V.F.1	Signed Transmittal Letter	NA	-
V.F.2	Title page	Title page	-
V.F.3	Table of Contents	Table of Contents	*i*
V.F.4	Executive Summary	Executive Summary	*vii*
V.F.5	Description of the Coalition Group geographical area	Description of the Watershed	4
V.F.6	Monitoring objectives and design	Monitoring Objectives	5
V.F.7	Sampling site descriptions and rainfall records for the time period covered under the AMR	Sampling Site Locations and Land Uses; Summary of Sampling Conditions	8; 26
V.F.8	Location map(s) of sampling sites, crops and land uses	Appendix E: Drainage Maps	CD
V.B.1;[1] V.F.9; V.F.11	An Excel workbook containing an export of all data records uploaded and/or entered into the CEDEN-comparable database (surface water data). The workbook shall contain, at a minimum, those items detailed in the most recent version of the third-party's approved QAPP Guidelines; Tabulated results of all analyses arranged in tabular form so that the required information is readily discernible; Electronic data submittal.	Appendix C: Tabulated Monitoring Results	CD

[5] Prior to adoption of the WDR, the Coalition was subject to a Conditional Waiver of Waste Discharge Requirements for the Irrigated Lands Regulatory Program (ILRP) and subsequent amendments to the ILRP requirements (WQO-2004-0003, SWRCB 2004, R5-2005-0833, R5-2008-0005, R5-2009-0875).

[6] Monitoring and Reporting Program (Attachment B to R5-2014-0030), Section V.F.

MRP Section	AMR Requirement	Report Section Headings	Page
V.F.10	Discussion of data relative to water quality objectives/Trigger Limits and water quality management plan milestones/Basin Plan Amendment Workplan (BPAW) updates, if applicable	Assessment of Water Quality Objectives	43
V.F.12	Sampling and analytical methods used	Sampling and Analytical Methods	16
V.B.5;[1] V.B.7.c.; V.F.13	Electronic copies of all applicable laboratory analytical reports on a CD; Chain of custody (COCs) and sample receipt documentation; Associated laboratory and field quality control samples results	Appendix B: Lab Reports and Chains of Custody	CD
V.F.14	Summary of Quality Assurance Evaluation results (as identified in the most recent version of the Coalition's QAPP for Precision, Accuracy and Completeness)	Quality Assurance	42
V.B.3-4;[1] V.F.15	Electronic copies of all field sheets; Electronic copies of photos obtained from all surface water monitoring sites, clearly labeled with the CEDEN comparable station code and date; Specification of the method(s) used to obtain estimated flow at each surface water monitoring site during each monitoring event	Appendix A: Field Log Copies	CD
V.F.16	Summary of exceedances of water quality objectives/Trigger Limits occurring during the reporting period and surface water-related pesticide use information	Assessment of Water Quality Objectives; Appendix D: Exceedance Reports	43; CD
V.F.17	Actions taken to address water quality exceedances that have occurred, including, but not limited to, revised or additional management practices implemented	Management Practices and Actions Taken; Appendix F: SVWQC Outreach Materials	65; CD
V.F.18	Evaluation of monitoring data to identify temporal and spatial trends and patterns	Trend Analysis; Appendix G: Trend Analysis Results	61; CD
V.F.19	Summary of Nitrogen Management Plan information submitted to the Coalition	---[2]	NA

MRP Section	AMR Requirement	Report Section Headings	Page
V.F.20	Summary of Management Practice information collected as part of Farm Evaluations	Summary of Farm Evaluation Data	NA
V.F.21	Summary of comparison of township Groundwater Protection Targets and actual value achieved for each township	---[3]	NA
V.F.22	Summary of Mitigation Monitoring	---[4]	NA
V.F.23	Summary of education and outreach activities	Management Practices and Actions Taken; Appendix F: SVWQC Outreach Materials	65; CD
V.F.24	Reduced Monitoring/Management Plan Verification Option Reports	---	NA
V.F.25	Conclusions and recommendations	Conclusions and Recommendations	68

1. Quarterly Submittals of monitoring results for the 2021 Monitoring Year (WDR Provision V.B.) are re-submitted with the AMR.
2. The 2021 Nitrogen Management Plan (NMP) Summary Report will be submitted to the ILRP by 30 November 2022.
3. This item is not applicable to this surface water monitoring report.
4. This item is not applicable because no mitigation monitoring was conducted in 2021.

With the exceptions noted in **Table 1,** all report elements required by the WDR are included in this report.

Description of the Watershed

The Sacramento River Watershed drains over 27,000 square miles of land in the northern part of California's Central Valley into the Sacramento River. The upper watersheds of the Sacramento River region include the Pit River watershed above Lake Shasta and the Feather River watershed above Lake Oroville. The Sacramento Valley drainages include the Colusa, Cache Creek, and Yolo Bypass watersheds on the west side of the valley, and the Feather, Yuba, and American River watersheds on the east side of the valley. The Coalition also monitors in the Cosumnes River watershed, which is not part of the Sacramento River Watershed.

Beginning at its northern terminus near the city of Redding, the Sacramento Valley stretches approximately 180 miles to the southeast, where it merges into the Sacramento-San Joaquin River Delta south of the Sacramento metropolitan area at Rio Vista. The valley is 30 to 45 miles wide in the southern to central parts, but narrows to about 5 miles wide near Redding. Its elevation decreases from 300 feet at its northern end to near sea level in the Delta. The greater Sacramento River Watershed includes sites from 5,000 feet in elevation to near sea level.

The Sacramento River Basin is a unique mosaic of farm lands, refuges, and wetlands managed for waterfowl habitat; spawning grounds for numerous salmon species and steelhead trout; and the cities and rural communities that make up this region. This natural and working landscape between the crests of the Sierra Nevada and the Coast Range includes the following:

- More than a million acres of family farms that provide the economic engine for the region; provide a working landscape and pastoral setting; and serve as valuable habitat for waterfowl along the Pacific Flyway. The predominant crops include: rice, general grain and hay, improved pasture, corn, tomatoes, alfalfa, almonds, walnuts, prunes, safflower, and vineyards.
- Habitat for 50% of the threatened and endangered species in California, including the winter-run and spring-run salmon, steelhead, and many other fish species.
- Six National Wildlife Refuges, more than fifty state Wildlife Areas, and other privately managed wetlands that support the annual migration of waterfowl, geese, and water birds in the Pacific Flyway. These seasonal and permanent wetlands provide for 65% of the North American Waterfowl Management Plan objectives.
- The small towns and rural communities that form the backbone of the region, as well as the State Capital that serves as the center of government for the State of California.
- The forests and meadows in the numerous watersheds of the Sierra Nevada and Coast Range.

Monitoring Objectives

The Coalition's monitoring program conforms to the goals of the Nonpoint Source (NPS) Program and achieves the following objectives as a condition of the WDR's MRP:

1. Track, monitor, assess, and report program activities;
2. Ensure consistent and accurate reporting of monitoring activities;
3. Target NPS Program activities at the watershed level;
4. Coordinate with public and private partners; and
5. Track implementation of management practices to improve water quality and protect existing beneficial uses.

In accordance with WDR requirements, the Coalition is achieving these objectives by implementing a MRP that evaluates water and sediment samples for the presence of statistically significant toxicity and exceedances of applicable numeric water quality objectives and ILRP Trigger Limits. The Coalition initiates follow-up actions designed to identify constituents causing significant toxicity when toxicity is of sufficient magnitude. Exceedances of numeric objectives and ILRP Trigger Limits for chemical, physical, and microbiological parameters trigger follow-up actions designed to identify potential sources of these exceedances and to inform potential users of the products that contain constituents of concern. Additionally, the Coalition is evaluating the degree of implementation of current management practices in priority drainages and represented drainages (i.e., those where Management Plans have been triggered) and recommending additional practices as water quality results indicate a need to do so. The Coalition is committed to the principle of adaptive management to control specific discharges of waste from agricultural lands that are having an impact on water quality. This iterative approach allows for the most effective use of limited human and fiscal resources.

The parameters monitored during the 2021 Monitoring Year by the Coalition to achieve these objectives are as specified in the current WDR and MRP (*Order No. R5-2014-0030*):

- Water column and sediment toxicity
- Physical and conventional parameters in water
- Organic carbon
- Pathogen indicator organisms in water
- Trace metals in water
- Pesticides in water
- Nitrogen and phosphorus compounds in water

The proposed frequency and schedule for water quality sample collection used to assess the presence and concentration of the above-listed parameters in Coalition receiving waters are submitted to the Central Valley Water Board each year on August 1 in the form of the Coalition's Monitoring Plan Update (MPU). The WDR does not explicitly state the individual constituents that require monitoring each year but allows for the Coalition to make that determination based on guidance provided in the WDR and MRP and the amounts and time

periods of pesticide applications in representative and integration site drainages using California Department of Pesticide Regulation (CDPR) pesticide use reporting (PUR) data.

Additional guidance for the monitoring of pesticides was established in November 2016 with the Central Valley Water Board's requirement that all Central Valley agricultural water quality coalitions begin using a protocol for prioritizing and selecting pesticides for surface water monitoring (ILRP Pesticides Evaluation Protocol or PEP). The PEP was developed by a Pesticide Evaluation Advisory Workgroup and outlines the required steps that Coalition's must use to process PUR data when developing annual monitoring plans. The PEP process requires the Coalition to monitor specific registered pesticides based on (1) their rate of application in a given drainage (lb applied per drainage) and (2) a pesticide-specific relative risk (the ratio of the amount of chemical applied to a reference value with a specific averaging period). As a result, not all pesticides are monitored at each site for every monitoring event, and instead Coalition pesticide monitoring reflects the frequency and intensity of pesticide use within an individual drainage.

The current WDR and MRP also require testing for 303(d)-listed constituents identified in water bodies downstream from Coalition sites and discharged within the watershed if irrigated agriculture has been identified as a contributing source within the Sacramento River Watershed and such monitoring has been requested by the Central Valley Water Board's Executive Officer.

Specific individual parameters measured for 2021 Coalition Monitoring are listed in **Table 2**. Note that not all parameters were monitored at every site for every monitoring event.

Table 2. Constituents Monitored for the 2021 Monitoring Year

Analyte	Quantitation Limit[(a)]	Reporting Unit
Physical Parameters		
Flow	NA	CFS (Ft^3/Sec)
pH	0.01 [(b)]	-log[H^+]
Specific Conductivity	1 [(b)]	µS/cm
Dissolved Oxygen	0.01 [(b)]	mg/L
Temperature	0.1 [(b)]	˚C
Hardness, total as $CaCO_3$	5	mg/L
Turbidity	0.055	NTU
Total Suspended Solids	3.0	mg/L
Dissolved Organic Carbon	0.5	mg/L
Total Organic Carbon	0.5	mg/L
Grain size (sediment)	0.01	% fraction
Solids (sediment)	0.1	% fraction
Pathogen Indicators		
E. coli bacteria	1	MPN/100 mL
Water Column Toxicity		
Ceriodaphnia, 96-h acute	NA	% Survival
Hyalella, 96-h acute	NA	% Survival
Selenastrum, 96-h short-term chronic	NA	% Survival

Analyte	Quantitation Limit[(a)]	Reporting Unit
Sediment Toxicity		
Hyalella, 10-day short-term chronic	NA	% Survival
Pesticides		
Carbamates	(c)	µg/L
Fungicide	(c)	µg/L
Herbicides	(c)	µg/L
Insecticides	(c)	µg/L
Neonictinoid	(c)	µg/L
Organochlorine	(c)	µg/L
Organophosphorus	(c)	µg/L
Pyrethroids	(c)	ng/L
Triazines	(c)	µg/L
Trace Elements		
Arsenic	0.5	µg/L
Boron	10	µg/L
Copper	0.5	µg/L
Nutrients		
Ammonia as N	0.1	mg/L
Nitrate + Nitrite as N	0.05	mg/L
Orthophosphate as P	0.01	mg/L
Phosphorus, total	0.01	mg/L
Total Kjeldahl Nitrogen	0.2	mg/L
Total Nitrogen	0.2	mg/L

Notes:

a. The Quantitation Limit (QL) represents the concentration of an analyte that can be routinely measured in the sampled matrix within the stated limits and confidence in both identification and quantitation.
b. Detection and reporting limits are not strictly defined. Value is required reporting precision.
c. Limits are different for individual pesticides.

Sampling Site Descriptions

To successfully implement the monitoring and reporting program requirements contained in the ILRP adopted by the Central Valley Water Board in June 2003, the Coalition worked directly with landowners in the 21 counties within the Sacramento River Watershed to identify and develop ten (now 13[7]) subwatershed groups. Representatives from each subwatershed group utilized agronomic and hydrologic data generated by the Coalition to prioritize watershed areas for initial evaluation that were used to ultimately select monitoring sites in their respective areas based upon existing infrastructure, historical monitoring data, land use patterns, historical pesticide use, and the presence of 303(d)-listed water bodies.

Coalition members selected sampling sites in watersheds based upon the following fundamental assumptions regarding management of non-point source discharges to surface water bodies: (1) Landscape scale sampling at the bottom of drainage areas allows determination of the presence of water quality problems using a variety of analytical methods, including water column and sediment toxicity testing, water chemistry analyses, and bioassessment; (2) Strategic source investigations utilizing Geographic Information Systems can be used to identify upstream parcels with attributes that may be related to the analytical results, including crops, pesticide applications, and soil type; and (3) Management practice effectiveness can best be assessed by subwatershed coalitions at the drainage and subwatershed scale to determine compliance with water quality objectives in designated water bodies. Results from farm-level management practices evaluations are used to complement Coalition efforts on the watershed scale by providing crop-specific information that supports management practice recommendations.

The Coalition uses a "representative monitoring" approach to achieve the goals of the 2014 MRP:

- Representative monitoring is conducted at sites in drainages representative of larger regions based on shared agricultural and geographic characteristics;
- Representative monitoring includes a cycle of two years of "Assessment" Monitoring for the broader suite of ILRP analytes, followed by two years of sampling needed for Management Plan implementation (referred to as "Core" Monitoring or "Non-Assessment" Monitoring); and
- Monitoring schedules and the analytes monitored are customized based on the characteristics of individual subwatersheds and Management Plans.

Monitoring sites visited during the 2021 Monitoring Year were all previously monitored and included 17 representative sites, three integration sites, and two special project sites where monitoring requirements were triggered by active Management Plans.

[7] This AMR is the last that will report Coalition monitoring data for the Goose Lake Subwatershed. On 13 August 2021, the Central Valley Water Board approved for exemption from the Irrigated Lands Regulatory Program 7,000 irrigated acres of pasture and hay operations in the Goose Lake area.

SAMPLING SITE LOCATIONS AND LAND USES

The water and sediment sites monitored by the Coalition during the 2021 Monitoring Year are listed in **Table 3**. All sites monitored were approved by the Central Valley Water Board as MRP compliance sites. A watershed-wide map of Coalition sites is presented in **Figure 1**. Site-specific drainage maps with land use patterns for all monitoring locations are provided in **Appendix E**.

Table 3. Monitoring Sites for 2021 Coalition Monitoring

Subwatershed	Site Name	Latitude	Longitude	Agency	Site ID & Category (Fig. 1)	
Butte Yuba Sutter	Gilsizer Slough at George Washington Road	39.009	-121.6716	SVWQC	GILSL	SP
Butte Yuba Sutter	Lower Honcut Creek at Highway 70	39.30915	-121.59542	SVWQC	LHNCT	REP
Butte Yuba Sutter	Lower Snake River at Nuestro Road	39.18531	-121.70358	SVWQC	LSNKR	REP
Butte Yuba Sutter	Pine Creek at Highway 32	39.75338	-121.97124	SVWQC	PNCHY	REP
Butte Yuba Sutter	Sacramento Slough bridge near Karnak	38.785	-121.6533	SVWQC	SSKNK	INT
Colusa Glenn	Colusa Basin Drain above Knight's Landing	38.8121	-121.7741	SVWQC	COLDR	INT
Colusa Glenn	Freshwater Creek at Gibson Road	39.17664	-122.18915	SVWQC	FRSHC	REP
Colusa Glenn	Walker Creek near 99W and CR33	39.62423	-122.19652	SVWQC	WLKCH	REP
El Dorado	North Canyon Creek	38.7604	-120.7102	SVWQC	NRTCN	REP
Goose Lake	Lower Lassen Creek	41.89103	-120.35594	GLC	LOWLC	REP
Lake	McGaugh Slough at Finley Road East	39.00417	-122.86233	SVWQC	MGSLU	SP
Lake	Middle Creek upstream from Highway 20	39.17641	-122.91271	SVWQC	MDLCR	REP
Napa	Pope Creek upstream of Lake Berryessa	38.64637	-122.36424	PCWG	PCULB	REP
Pit River	Pit River at Pittville Bridge	41.0454	-121.3317	NECWA	PRPIT	REP
PNSSNS	Coon Creek at Brewer Road	38.93399	-121.45184	PNSSNS	CCBRW	REP
Sacramento Amador	Cosumnes River at Twin Cities Road	38.29098	-121.38044	SVWQC	CRTWN	REP
Sacramento Amador	Grand Island Drain near Leary Road	38.2399	-121.5649	SVWQC	GIDLR	REP
Shasta Tehama	Anderson Creek at Ash Creek Road	40.418	-122.2136	SVWQC	ACACR	REP
Solano	Ulatis Creek at Brown Road	38.307	-121.794	SVWQC	UCBRD	REP
Solano[1]	Shag Slough at Liberty Island Bridge	38.30677	-121.69337	SVWQC	SSLIB	INT
Upper Feather River	Middle Fork Feather River above Grizzly Creek	39.816	-120.426	UFRWG	MFFGR	REP
Yolo	Willow Slough Bypass at Pole Line Road	38.59015	-121.73058	SVWQC	WLSPL	REP

[1] Shag Slough at Liberty Island Bridge drainage includes areas in both the Solano and Yolo Subwatersheds

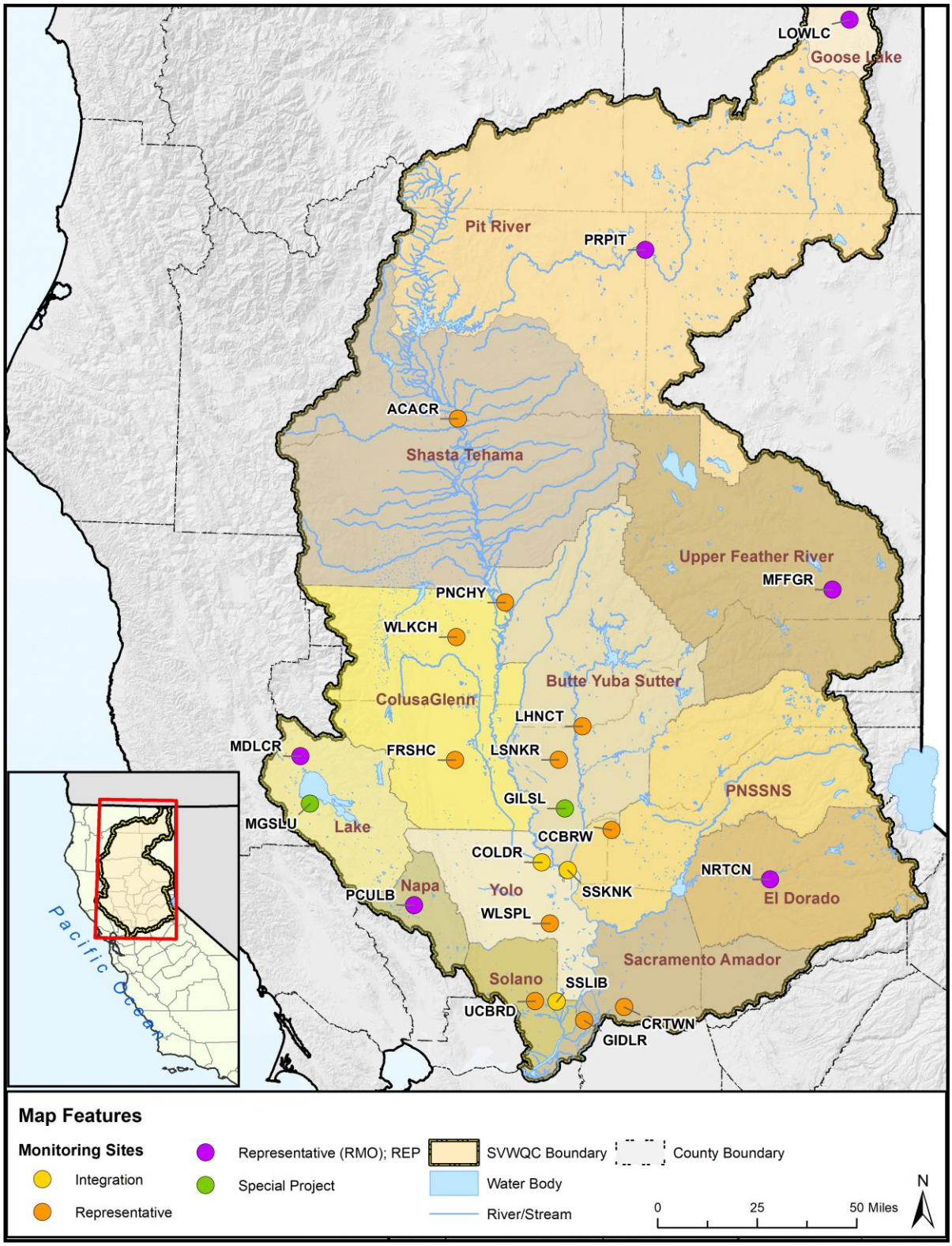

Figure 1. 2021 Coalition Monitoring Sites

SITE DESCRIPTIONS

Butte-Yuba-Sutter Subwatershed

Gilsizer Slough at George Washington Road (GILSL)

Gilsizer Slough is an unlined, storm drainage outfall canal that runs from the Gilsizer County Drainage District's north pump station approximately 15 miles to the Sutter Bypass, draining 6,005 total acres. The monitoring location is located roughly 1.5 miles from its confluence with the Sutter Bypass and is a natural drainage channel that historically drained Yuba City and the area south of town. Principal crops grown in this area include prunes, walnuts, peaches, and almonds. This special project site currently is a Management Plan site for this subwatershed.

Lower Honcut Creek at Highway 70 (LHNCT)

Lower Honcut Creek (in the Lower Honcut Creek drainage) was selected to represent the drainages in the eastern part of the Butte-Yuba-Sutter Subwatershed. This drainage includes the dominant crops grown in the area and typically has flows allowing sampling through irrigation season. The sampling site is located approximately 3.5 miles from its confluence with the Feather River. Dominant crops in this drainage include rice, walnuts, prunes, pasture, citrus, olive, and grapes. Lower Honcut Creek receives flows from North Honcut Creek and South Honcut Creek, which extend up into the foothills and include more pasture acreage. This is a representative site for this subwatershed.

Lower Snake River at Nuestro Road (LSNKR)

The Lower Snake River is an unlined irrigation supply and runoff canal that serves approximately 25,000 total acres and includes a relatively high percentage of rice acreage. The other predominant crops include prunes, peaches, idle acreage, and operations producing flowers, nursery stock, and Christmas trees. This is a representative site for this subwatershed.

Pine Creek at Highway 32 (PNCHY)

The watershed sampled upstream from the Pine Creek monitoring site represents approximately 28,000 acres of varied farmland, riparian habitat, and farmsteads. The predominant crops in this area are walnuts, almonds, prunes, wheat, oats, barley, beans, squash, cucumbers, alfalfa, pasture, and safflower. This is a representative site for this subwatershed.

Sacramento Slough Bridge near Karnak (SSKNK)

This site aggregates water from all areas in the subwatershed between the Feather and Sacramento Rivers. The major contributing areas include the areas downstream of the Butte Slough and Wadsworth monitoring sites. These areas include Sutter Bypass and its major inputs from Gilsizer Slough, Reclamation District (RD) 1660, RD 1500, and the Lower Snake River. This is an integration site for this subwatershed.

Colusa Glenn Subwatershed

Colusa Basin Drain above Knight's Landing (COLDR)

This site is near the outfall gates of the Colusa Basin Drain before its confluence with the Sacramento River. This site is downstream of all of the other monitoring sites within the basin. The upstream acreage consists of almonds, tomatoes, wetlands, pasture, corn, and walnuts. This is an integration site for this subwatershed.

Freshwater Creek at Gibson Road (FRSHC)

The Freshwater Creek drainage includes approximately 83,000 total acres. Irrigated acreage (excluding rice acreage) is approximately 19,000 acres. Predominant crops in the drainage are rice, tomatoes, idle acreage, squash, grain, pasture, and safflower. This is a representative site for this subwatershed.

Walker Creek near 99W and CR33 (WLKCH)

The Walker Creek drainage is located east of Wilson Creek in Glenn County, and the Walker Creek monitoring site is located 1.3 miles north of the Town of Willows. The Walker Creek drainage includes approximately 27,000 total irrigated acres. Predominant crops in this drainage are almonds, rice, corn, and alfalfa. This is a representative site for this subwatershed.

El Dorado Subwatershed

The El Dorado subwatershed is currently operating under an approved *Reduced Monitoring/Management Practices Verification Option*.

North Canyon Creek (NRTCN)

This site captures representative agricultural drainage from the Camino-"Apple Hill" drainage in El Dorado County. Crops grown in this region include apples, pears, wine grapes, stone fruit, and Christmas trees. This site is approximately one (1) mile upstream from the confluence with the South Fork American River and is a perennial stream. This is a representative site for this subwatershed.

Goose Lake Subwatershed

The Goose Lake subwatershed is currently operating under an approved *Reduced Monitoring/Management Practices Verification Option*. Monitoring in this subwatershed was conducted in coordination with the Goose Lake Subwatershed Group.

On August 13, 2021, the Central Valley Water Board approved for exemption from the ILRP 7,000 irrigated acres of pasture and hay operations in the Goose Lake area.

Lower Lassen Creek (LOWLC)

The land use pattern in the Lassen Creek drainage is similar to the Goose Lake Basin as a whole. Lassen Creek originates in predominately publicly owned lands that are managed primarily for dispersed recreation and livestock grazing. Lassen Creek flows out of the Warner Mountains

towards Goose Lake, and land uses along this waterbody focus on dry-land alfalfa, native meadow hay production, and irrigated pasture for livestock. This is a representative site for this subwatershed.

Lake Subwatershed

The Lake subwatershed is currently operating under an approved *Reduced Monitoring/Management Practices Verification Option*. Monitoring in this subwatershed was conducted in coordination with the Lake Subwatershed Group.

Middle Creek Upstream from Highway 20 (MDLCR)

The Middle Creek drainage contains approximately 60,732 acres. Over 55,000 acres are listed as Native Vegetation with the U.S. Forest Service controlling the majority of the land. Irrigated agriculture constitutes approximately 1,100 acres farmed by members participating in the Lake County Watershed Group. This includes 374 acres of walnuts, 308 acres of grapes, 186 acres of pears, 159 acres of hay/pasture, 10 acres of specialty crops/nursery crops, and about 70 acres of wild rice.

The sampling location was chosen to avoid influence from the town of Upper Lake, and captures approximately 60% of irrigated agricultural operations within this drainage. This is a representative site for this subwatershed.

McGaugh Slough at Finley Road East (MGSLU)

McGaugh Slough captures irrigated agricultural drainage from about 10,300 acres of orchard and vineyard crops in Lake County. This site characterizes the most prevalent drain for the Big Valley, which is the most intensive area for agricultural operations in Lake County. This is a special project site for this subwatershed.

Napa Subwatershed

The Napa subwatershed is currently operating under an approved *Reduced Monitoring/Management Practices Verification Option*. Monitoring in this subwatershed was conducted in coordination with the Napa Subwatershed Group.

Pope Creek above Lake Berryessa (PCULB)

The site on Pope Creek in Napa County is downstream of major stormwater runoff and above Lake Berryessa. Primary crops in the drainage are vineyards and olive orchards. Additional tributaries in the Pope Creek area (Burton Creek, Swartz Creek, Maxwell Creek, and upper Pope Creek) have been sampled to help establish regional characteristics for management plan source evaluations. This site is a representative site for this subwatershed.

Pit River Subwatershed

The Pit River subwatershed is currently operating under an approved *Reduced Monitoring/Management Practices Verification Option*. Monitoring in this subwatershed was conducted in coordination with the Northeastern California Watershed Association (NECWA).

Pit River at Pittville Bridge (PRPIT)

This site captures drainage from Big Valley, Ash Creek, and Horse Creek. The water quality monitored at this site represents drainage from native pasture (the primary land use), as well as alfalfa, oat hay, grain and duck marsh, and incorporates drainage from approximately 9,000 acres in the Fall River Valley. This is a representative site for this subwatershed.

Placer-Nevada-South Sutter-North Sacramento Subwatershed

Monitoring in this subwatershed was conducted in coordination with the PNSSNS Subwatershed Group.

Coon Creek at Brewer Road (CCBRW)

This site captures drainage from the Middle Coon Creek drainage area as identified in the Placer-Northern Sacramento Drainage Prioritization Table in the Coalition's Watershed Evaluation Report (WER). This site is on Coon Creek about 6 miles northwest of the town of Lincoln and includes predominantly agricultural acreage. The drainage includes approximately 65,000 irrigated acres of rice, pasture, grains, and Sudan grass, with a high percentage of rice acreage. Irrigated acreage (excluding rice) is approximately 13,000 acres. This is a representative site for this subwatershed.

Sacramento/Amador Subwatershed

Cosumnes River at Twin Cities Road (CRTWN)

This site characterizes flows from the eastern portion of the subwatershed via the Cosumnes River and a handful of tributary creeks that originate in the foothills. Contributing agricultural acreage includes pasture, vineyards, corn, and grains. This site captures drainage from the two largest drainages in the subwatershed: Lower Cosumnes and Middle Cosumnes rivers, which drain approximately 55,000 irrigated acres. This is a representative site for this subwatershed.

Grand Island Drain near Leary Road (GIDLR)

Grand Island is located in the heart of the Sacramento Delta. Crops include alfalfa, corn, safflower, apples, pears, cherries, blueberries, asparagus, grapes, and pasture land. Water is pumped on to the island at several locations. The monitoring site is located just up-slough from a station that returns water to the Sacramento River. Approximately 8,000 irrigated acres drain to the monitoring site. This is a representative site for this subwatershed.

Shasta/Tehama Subwatershed

Anderson Creek at Ash Creek Road (ACACR)

Anderson Creek was identified as the highest priority drainage in the Shasta County portion of the Shasta/Tehama subwatershed. This ranking was based on total irrigated acreage, crop types by acreage, and amount and type of pesticide use. Anderson Creek originates about three miles west of the city of Anderson and flows into the Sacramento River. Crops are predominantly pasture, followed by walnuts and alfalfa/hay, and smaller amounts of other field and orchard crops. Total irrigated land is 8,989 acres. This is a representative site for this subwatershed.

Solano Subwatershed

Shag Slough at Liberty Island Bridge (SSLIB)

Shag Slough drains a large portion of the South Yolo Bypass, which includes areas in both the Solano and Yolo Subwatersheds. Crops grown in this drainage area include corn, safflower, grain, vineyards, tomatoes, and irrigated pasture. The Liberty Island Bridge site is approximately 2.5 to 3 miles southwest of the Toe Drain in Shag Slough. Like the Toe Drain, it is a tidally influenced site and is likely to contain a mixture of Toe Drain water along with water from other sub-drainages within the South Yolo Bypass and the Southwest Yolo Bypass. Due to the difficulty in accessing the Toe Drain for sampling, Shag Slough replaced the original Toe Drain sampling location in late 2005. This is an integration site for this subwatershed.

Ulatis Creek at Brown Road (UCBRD)

Ulatis Creek is a flood control project (FCP) that drains the majority of the central portion of Solano County. The Ulatis Creek FCP monitoring site is located on Brown Road approximately 8.5 miles south of Dixon and 1.5 miles east of State Highway 113. This site drains the Cache Slough area, as designated in the Yolo/Solano subwatershed map, and empties into Cache Slough. The major crops in this area include wheat, corn, pasture, tomatoes, alfalfa, Sudan grass, walnuts, and almonds. This representative site is currently a Management Plan site for this subwatershed.

Upper Feather River Watershed

The Upper Feather River subwatershed is currently operating under an approved *Reduced Monitoring/Management Practices Verification Option*. Monitoring in this subwatershed was conducted in coordination with the UFRW Group.

Agriculture in this subwatershed is localized in mountain valleys that are suitable for grazing and growing alfalfa, hay, and grain crops. Monitoring in this subwatershed is focused on characterizing drainage from three valleys with considerable agricultural acreage.

Middle Fork Feather River Above Grizzly Creek (MFFGR)

The Middle Fork Feather River above Grizzly Creek is below the last irrigated site in the Sierra Valley subwatershed and has year-round flow in most years. Agriculture in this drainage is localized in mountain valleys that are suitable for grazing and growing alfalfa, hay, and grain crops. This is a representative site for this subwatershed.

Yolo Subwatershed

Willow Slough Bypass at Pole Line Road (WLSPL)

The Willow Slough Bypass is a large drainage including approximately 102,000 total acres. Irrigated acreage (excluding rice acreage) is approximately 66,000 acres. Predominant crops in the drainage are grain, pasture, corn, tomatoes, rice, almonds, and walnuts. This is a representative site for this subwatershed.

Sampling and Analytical Methods

The objective of data collection for this monitoring program is to produce data that represent, as closely as possible, *in situ* conditions of agricultural discharges to water bodies in the Sacramento Valley. This objective is achieved by using standard accepted methods to collect and analyze surface water and sediment samples. Assessing the monitoring program's ability to meet this objective is accomplished by evaluating the resulting laboratory measurements in terms of detection limits, precision, accuracy, representativeness, comparability, and completeness, as described in the Coalition's QAPP (SVWQC 2010; amended 2017) and approved by the Central Valley Water Board. Additionally, the Coalition submits an electronic QAPP (eQAPP) to the Central Valley Water Board on a quarterly basis with its quarterly data submittal. The eQAPP alerts Central Valley Water Board staff to the Coalition's event-based analysis of constituents and their associated analytical methods, along with occasional changes to a laboratory's analytical recovery limits for certain parameters.

Surface water samples were collected for analysis of the constituents listed in **Table 2** as specified in the Coalition's 2021 Monitoring Plan Update. Surface water and sediment samples were collected for chemical analyses and toxicity testing. All samples were collected and analyzed using the methods specified in the QAPP and eQAPP; any deviations from these methods were noted.

SAMPLE COLLECTION METHODS

All samples were collected in a manner appropriate for the specific analytical methods used, and to ensure that water column samples were representative of the flow in the channel cross-section. Water quality samples were collected using clean techniques that minimize the risk of sample contamination. Samples were collected at approximately mid-stream and mid-depth at approximately the location of greatest flow (where feasible). Sample collection methods are dependent on sampling site and event characteristics.

Sediment sampling was conducted at sampling sites on an approximately 50-meter reach of the waterbody near the water sampling location. If USGS methods were applicable, sediment sub-samples were collected from five to ten wadable, depositional zones. Depositional zones include areas on the inside bend of a stream or areas downstream from obstacles such as boulders, islands, sand bars, or simply shallow waters near the shore. In low-energy, low-gradient waterbodies, composite samples may be collected from the bottom of the channel using appropriate equipment, as specified in the Coalition's QAPP.

Details of the standard operating procedures (SOPs) for collection of surface water and sediment samples are provided in the Coalition's QAPP. The sites visited and number of samples collected for 2021 Coalition Monitoring are summarized in **Table 4**. The Coalition's monitoring strategy for the 2021 Monitoring Year was designed to characterize high priority drainages that are representative of a subwatershed's dominant agricultural crops and practices. This sampling approach was initially designed to comply with the requirements in *Order No. R5-2008*-0005 and with the later adopted ILRP MRP (*Monitoring and Reporting Program Order No. R5-2009-0875*); this approach was maintained for the current WDR and MRP (*Order No. R5-2014-0030*). The elements that are key to achieving the Coalition's goals and satisfying the intent of the requirements of the MRP are (1) the Coalition's prioritization process for selecting representative

drainages and monitoring sites, and (2) identification of monitoring parameters and schedules appropriate for these representative drainages. This approach was detailed in the Coalition's 2009 Monitoring and Reporting Program Plan, as required by *Order No. R5-2008-0005*, and the monitoring plan is updated annually in August, as required by *Order No. R5-2014-0030*.

Table 4. 2021 Coalition Monitoring Year: Planned Samples, October 2020 – September 2021

				Core Parameters										Metals				Pesticides in Water																								Toxicity				
Subwatershed	Representative	SiteID	SITE CATEGORY: REP=Representative INT=Integrative SP=Special Project	Water Column Sample Events	Sediment Sample Events	Field Measured Group	Dissolved Organic Carbon	Total Organic Carbon	Total Suspended Solids	Turbidity	E. coli	Nutrients Group	Ammonia, Total as N	Arsenic (total)	Boron	Copper	Hardness	2,4-D acids & salts	ATRAZINE	CARBARYL	CHLOROPICRIN	CHLOROTHALONIL	CHLORPYRIFOS	CYPRODINIL	Diazinon	Dichlorvos (DDVP)	DIURON	Imidacloprid	Malathion	METHOMYL	OXYFLUORFEN	PARAQUAT DICHLORIDE	PENDIMETHALIN	PHORATE	Propiconazole	PYRACLOSTROBIN	PYRIDABEN	SIMAZINE	Tebuconazole	TMDL Pyrethroids	TRIFLURALIN	Algae - Selenastrum	Water Flea - Ceriodaphnia	Hyalella azteca (water)	Hyalella azteca	Grain Size[1]	Sediment Chemistry[2]
ButteYubaSutter	Lower Feather River	SSKNK	INT	4	2	4	4	4	4	4	4	4				2	2			2	2			1		1				1		1	1		1	1		1	1	4		4	2	4	2	2	2
ButteYubaSutter	Lower Honcut Creek	LHNCT	REP	6	2	6	5	5			2																													5				5	2	2	2
ButteYubaSutter	Pine Creek	PNCHY	REP	6	2	6	5	5			2																													5				5	2	2	2
ButteYubaSutter	Lower Snake River	LSNKR	REP	6	2	6	5	5			3			2																										5				5	2	2	2
ButteYubaSutter	Wadsworth	GILSL	SP	4		4																	4		4																						
ColusaGlenn	Freshwater Creek	FRSHC	REP	6	2	6	5	5			2																													5				5	2	2	2
ColusaGlenn	Lower Colusa Drain	COLDR	INT	4	2	4	4	4	4	4	4	4				1	1		2		1										1			1	1	1	1		1	4		2	1	4	2	2	2
ColusaGlenn	Walker Creek	WLKCH	REP	6	2	6	5	5			1																													5				5	2	2	2
ElDorado	Coloma El Dorado	NRTCN	REP	5		5	3	5	5	5	5	5				4	4		1	1					2						2									3		1	4	3			
GooseLake	Goose Lake	LOWLC	REP	3		3		3	3	3	3	3																																			
Lake	Upper Lake	MDLCR	REP	9	1	9	3	9	9	9	9	9				3	3								1		1	3					1					2		3		2	4	3	1	1	1
Lake	Upper Lake	MGSLU	REP	4		4						4																																		
Napa	Pope Creek	PCULB	REP	5		5		5	5	5	5	5				2	2				2								1												3					
NECWA	Big Lake	PRPIT	REP	7	1	7	5	7	7	7	7	7				3	3	3			2	2									2								5		7	2	5	1	1	1
PNSSNS	Middle Coon Creek	CCBRW	REP	5	2	5	5	5			2																													5				5	2	2	2
SacramentoAmador	Lower Cosumnes	CRTWN	REP	5	2	5	5	5			2																													5				5	2	2	2
SacramentoAmador	Sacramento Delta	GIDLR	REP	5	2	5	5	5			2		1	2																										5				5	2	2	2
ShastaTehama	Anderson Creek	ACACR	REP	5	2	5	5	5			2																													5				5	2	2	2
Solano	Cache Slough	UCBRD	REP	8	2	8	5	5			2																													5			3	5	2	2	2
Solano	South Yolo Bypass	SSLIB	INT	4	2	4	4	4	4	4	4	4				2	2		1		1						1			2	1	1			1		1	1	1	4	1	4	3	4	2	2	2
UpperFeatherRiver	Middle Fork Feather River	MFFGR	REP	3		3		3	3	3	3	3																				2															
Yolo	Willow Slough	WLSPL	REP	6	2	6	5	5			2		1		2																									5		1		5	2	2	2
			Totals	*116*	*30*	*116*	*78*	*99*	*44*	*44*	*66*	*48*	*2*	*4*	*2*	*17*	*17*	*3*	*4*	*3*	*8*	*2*	*4*	*1*	*7*	*1*	*2*	*3*	*1*	*3*	*4*	*6*	*2*	*1*	*3*	*2*	*2*	*4*	*3*	*78*	*1*	*24*	*19*	*78*	*30*	*30*	*30*

(1) Sediment grain size is analyzed along with sediment toxicity.
(2) Samples for pyrethroids, chlorpyrifos, diazinon, and TOC in sediment are analyzed if sample is found to be toxic.

ANALYTICAL METHODS

Water chemistry samples were analyzed as either filtered or unfiltered fractions of samples, depending on the analyte. Pesticide analyses were conducted only on unfiltered (whole) samples. Laboratories analyzing samples for this program have demonstrated the ability to meet the minimum performance requirements for each analytical method, including the ability to meet the project-specified quantitation limits (QL), the ability to meet acceptable precision and recovery requirements, and other analytical and quality control parameters documented in the Coalition's QAPP. Analytical methods used for chemical analyses follow accepted standard or USEPA methods or approved modifications to these methods. All procedures for analyses are documented in the QAPP or are available for review at each laboratory.

Toxicity Testing and Toxicity Identification Evaluations

Water quality samples were analyzed for toxicity to *Ceriodaphnia dubia*, *Selenastrum capricornutum,* and *Hyalella azteca* during the 2021 Monitoring Year. Sediment samples were analyzed for toxicity to *Hyalella azteca*. Toxicity tests were conducted using standard USEPA methods for these species.

- Determination of acute toxicity to *Ceriodaphnia* was performed as described in *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, Fifth Edition* (EPA-821-R-02-012; USEPA 2002a). Toxicity tests with *Ceriodaphnia* were conducted as 96-hour static renewal tests, with renewal 48 hours after test initiation.
- Determination of chronic toxicity to *Selenastrum* was performed using the non-EDTA procedure described in *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, Fourth Edition* (EPA-821-R-02-013; USEPA 2002b). Toxicity tests with *Selenastrum* were conducted as a 96-hour static non-renewal test.
- Determination of acute toxicity to *Hyalella azteca* was performed as described in *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, Fifth Edition* (EPA-821-R-02-012; USEPA, 2002a), with modifications for the Hyalella test based on the Southern California Coastal Water Research Project (SCCWRP) *Stormwater Monitoring Coalition: Toxicity Testing Laboratory Guidance Document* (December 2016)

For all initial toxicity screening tests at each site, 100% ambient water and a control were used for the acute water column tests. If 100% mortality to a test species was observed any time after the initiation of the initial screening test, then a multiple dilution test using a minimum of five sample dilutions was conducted with the initial water sample to estimate the magnitude of observed toxicity.

Procedures in the Coalition's QAPP state that if any measurement endpoint from any of the *Ceriodaphnia* or *Selenastrum* toxicity tests exhibits a statistically significant reduction in survival (*Ceriodaphnia*) or cell density (*Selenastrum*) of greater than or equal to 50% compared to the control, then Toxicity Identification Evaluation (TIE) procedures will be initiated using the most sensitive species to investigate the cause of toxicity. The 50% mortality threshold is

consistent with the approach recommended in guidance published by USEPA for conducting TIEs (USEPA 1996b), which recommends a minimum threshold of 50% mortality because the probability of completing a successful TIE decreases rapidly for samples with less than this level of toxicity. For samples that met these trigger criteria, Phase 1 TIEs to determine the general class of constituent (e.g., metal, non-polar organics) causing toxicity or pesticide-focused TIEs are conducted. TIE methods generally adhere to the documented USEPA procedures referenced in the QAPP. TIE procedures are initiated as soon as possible after toxicity is observed to reduce the potential for loss of toxicity due to extended sample storage. Procedures for initiating and conducting TIEs are documented in the QAPP.

The Coalition's WDR allows for initiation of a TIE for *Hyalella* when a greater than or equal to 50% reduction in organism survival is observed, but a sediment TIE is not required to be conducted.

Detection and Quantitation Limits

The Method Detection Limit (MDL) is the minimum analyte concentration that can be measured and reported with 99% confidence that the concentration is greater than zero. The Quantitation Limit (QL) represents the concentration of an analyte that can be routinely measured in the sampled matrix within stated limits and confidence in both identification and quantitation. For this program, QLs were established based on the verifiable levels and general measurement capabilities demonstrated by labs for each analytical method. Note that samples required to be diluted for analysis (or corrected for percent moisture for sediment samples) may have sample-specific QLs that exceed the established QLs. This is unavoidable in most cases.

Project Quantitation Limits

Laboratories generally establish QLs that are reported with the analytical results — these numeric values may be called *reporting limits, detection limits, reporting detection limits,* or several other terms used by different laboratories. In the quarterly eQAPP, these limits are referred to as reporting limits (RL). The MDLs and RLs are listed in **Table 5** and **Table 6.** Wherever possible, project QLs are lower than proposed or existing relevant numeric water quality objectives or toxicity thresholds, as required by the ILRP.

All analytical results between the MDL and RL are reported as numerical values and qualified as estimates (Detected, Not Quantified (DNQ); or sometimes, "J-flagged", which is a USEPA data qualifier indicating that the reported value is estimated).

Table 5. Laboratory Method Detection Limit (MDL) and Reporting Limit (RL) Data Quality Objectives for Analyses of Surface Water during the 2021 Monitoring Year

Method	Analyte	Fraction	Units	MDL	RL
Physical and Conventional Parameters					
SM20-2340C	Hardness, total as $CaCO_3$	Unfiltered	mg/L	1.7	5
SM2130 B	Turbidity	Unfiltered	NTU	0.2	0.5
SM2540 D	Total Suspended Solids (TSS)	Particulate	mg/L	1	3
SM5310B; SM5310C	Organic Carbon, Total (TOC)	Unfiltered	mg/L	0.3	0.5
SM5310B; SM5310C	Organic Carbon, Dissolved (DOC)	Unfiltered	mg/L	0.3	0.5
Pathogen Indicators					
SM 9223 B; SM 9223B-04	*E. Coli* bacteria	NA	MPN/100mL	1	1
Organophosphorus Pesticides					
EPA 8141A	Chlorpyrifos	Unfiltered	µg/L	0.0026	0.015
EPA 8141A	Diazinon	Unfiltered	µg/L	0.004	0.02
EPA 8141A	Malathion	Unfiltered	µg/L	0.03	0.1
EPA 8141A	Phorate	Unfiltered	µg/L	0.072	0.1
Organochlorine Pesticides					
EPA 8081A	Chlorothalonil	Unfiltered	µg/L	0.03	0.1
Carbamate and Urea Pesticides					
EPA 8321A	Carbaryl	Unfiltered	µg/L	0.05	0.1
EPA 8321A	Methomyl	Unfiltered	µg/L	0.05	0.1
Pyrethroid Pesticides					
EPA 625.1	Allethrin	Unfiltered	µg/L	0.0001	0.0005
EPA 625.1	Bifenthrin	Unfiltered	µg/L	0.0001	0.0005
EPA 625.1	Cyfluthrin	Unfiltered	µg/L	0.0002	0.0005
EPA 625.1	Cypermethrin	Unfiltered	µg/L	0.0002	0.0005
EPA 625.1	Deltamethrin/Tralomethrin	Unfiltered	µg/L	0.0002	0.001
EPA 625.1	Esfenvalerate/Fenvalerate	Unfiltered	µg/L	0.0002	0.001
EPA 625.1	Fenpropathrin	Unfiltered	µg/L	0.0002	0.0005
EPA 625.1	Lambda-Cyhalothrin	Unfiltered	µg/L	0.0002	0.0005
EPA 625.1	Permethrin	Unfiltered	µg/L	0.002	0.005
EPA 625.1	Tau-Fluvalinate	Unfiltered	µg/L	0.0002	0.0005
EPA 625.1	Tetramethrin	Unfiltered	µg/L	0.0002	0.0005
Insecticide					
EPA 625.1_MRM	Imidacloprid	Unfiltered	µg/L	0.002	0.004
EPA 625.1	Pyridaben	Unfiltered	µg/L	0.01	0.05
Other Herbicides					
EPA 615	2,4-Dichlorophenoxyacetic Acid	Unfiltered	µg/L	0.43	1
EPA 8321A	Diuron	Unfiltered	µg/L	0.2	0.4
EPA 8081A	Oxyfluorfen	Unfiltered	µg/L	0.008	0.05
EPA 549.2M; EPA 549.2	Paraquat	Unfiltered	µg/L	0.15	0.4
EPA 8141AM	Pendimethalin	Unfiltered	µg/L	0.53	1
EPA 8141A	Trifluralin	Unfiltered	µg/L	0.036	0.05

Method	Analyte	Fraction	Units	MDL	RL
Triazines					
EPA 8141A	Atrazine	Unfiltered	µg/L	0.1	0.5
EPA 8141A	Simazine	Unfiltered	µg/L	0.08	0.5
Fungicides					
EPA 8260BM	Chloropicrin	Unfiltered	µg/L	7.4	10
NCL ME 340	Cyprodinil	Unfiltered	µg/L	0.0031	0.02
NCL ME 340	Propiconazole	Unfiltered	µg/L	0.0069	0.02
NCL ME 340	Pyraclostrobin	Unfiltered	µg/L	0.0034	0.02
EPA 525.3	Tebuconazole	Unfiltered	µg/L	0.071	0.2
Trace Elements					
EPA 200.8	Arsenic	Filtered, Unfiltered	µg/L	0.06	0.5
EPA 200.8	Boron	Filtered, Unfiltered	µg/L	2	10
EPA 200.8	Copper	Filtered, Unfiltered	µg/L	0.15	0.5
Nutrients					
EPA 350.1; SM20-4500-NH3 C	Ammonia, Total as N	Unfiltered	mg/L	0.04	0.1
EPA 353.2	Nitrate + Nitrite as N	Unfiltered	mg/L	0.04	0.05
SM4500-P E; SM4500-P E (filt)	Orthophosphate, as P	Unfiltered	mg/L	0.004	0.01
SM4500-P E; SM 4500-P B/F	Phosphorus, Total	Unfiltered	mg/L	0.007	0.01
EPA 351.2	Total Kjeldahl Nitrogen	Unfiltered	mg/L	0.09	0.2
Calculated	Total Nitrogen	Unfiltered	mg/L	0.09	0.2

Table 6. Laboratory Method Detection Limit (MDL) and Reporting Limit (RL) Data Quality Objectives for Analyses of Sediments during the 2021 Monitoring Year

Method	Analyte	Fraction	Units	MDL	RL
Physical and Conventional Parameters					
[1]	Grain Size	Total	NA	NA	NA
EPA 160.3; SM20-2540 G	Solids	Total	%	NA	0.1
EPA 9060	Organic Carbon, Total (TOC)	Total	mg/kg dry wt.	200	500
Pyrethroids					
EPA 8270C(m)	Allethrin	Total	ng/g dry wt.	0.2	1
EPA 8270C(m)	Bifenthrin	Total	ng/g dry wt.	0.4	1
EPA 8270C(m)	Cyfluthrin	Total	ng/g dry wt.	0.5	1
EPA 8270C(m)	Cypermethrin	Total	ng/g dry wt.	0.4	1
EPA 8270C(m)	Deltamethrin/Tralomethrin	Total	ng/g dry wt.	0.5	1
EPA 8270C(m)	Esfenvalerate/Fenvalerate	Total	ng/g dry wt.	0.6	1
EPA 8270C(m)	Fenpropathrin	Total	ng/g dry wt.	0.3	1
EPA 8270C(m)	Lambda-Cyhalothrin	Total	ng/g dry wt.	0.3	1
EPA 8270C(m)	Permethrin	Total	ng/g dry wt.	0.5	1
EPA 8270C(m)	Tau-Fluvalinate	Total	ng/g dry wt.	0.2	1
EPA 8270C(m)	Tetramethrin	Total	ng/g dry wt.	0.3	1
Toxicity					
EPA 600/R-99-064M	*Hyalella*, 10-day short-term chronic	NA	% Survival	NA	NA

Note:

[1] Grain size tests are conducted under the guidelines prescribed in the *Standard Methods for the Examination of Water and Wastewater* (APHA, 22nd Edition), Section 2560 D

Monitoring Results

The following sections summarize the monitoring conducted by the Coalition and its subwatershed partners during the 2021 Monitoring Year (October 2020 through September 2021).

SUMMARY OF SAMPLE EVENTS CONDUCTED

This report presents monitoring results from 11 Coalition sampling events (Events 175-185), as well as data for events conducted by coordinating subwatershed monitoring programs and other agencies between October 2020 and September 2021. Samples collected for all of these events are listed in **Table 7**.

The Coalition and subwatershed monitoring events were conducted throughout the year. Analyses included water chemistry and toxicity, with pesticides monitored during months when higher use is typical. Sediment toxicity testing and/or chemistry analyses were also conducted by the Coalition as part of the assessment. The sites and parameters for all events were monitored in accordance with the Coalition's current MRP and QAPP.

The field logs for all Coalition and subwatershed samples collected for the October 2020 through September 2021 events, as well as associated site photographs, are provided in **Appendix A**.

Completeness

The objectives for completeness are intended to apply to the monitoring program as a whole. As summarized in **Table 7**, 96 of the 121 initial water column and toxicity sample events planned by the Coalition and coordinating programs were conducted, for an overall sample event success rate of approximately 79%. Executed sampling that differed from the 2021 Monitoring Plan Update is summarized below:

- Many areas of the Sacramento Valley were dry for parts of the 2021 Monitoring Year. Samples at GILSL (one event), LHNCT (one event), WLKCH (five events), MDLCR (three events), MGSLU (six events), PCULB (four events), and CRTWN (four events) were not collected for the specified number of events due to sites being dry or non-contiguous.
- Samples were not collected at NRTCN for one event due to unsafe sampling conditions.
- One event at LOWLC was postponed due to groundwater pumping influencing Lassen Creek flows just upstream of LOWLC. The postponed event was later canceled after the Central Valley Water Board exempted the Goose Lake area from ILRP requirements.

Table 7. Sampling for the 2021 Coalition Monitoring Year

Subwatershed (Agency)	Site ID	Sample Count		175	176		177	178	179	180	181	182	183	184	185
		Planned	Collected	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
Butte-Yuba-Sutter (SVWQC)	GILSL	5	4	-	-	-	W	-	-	W	W	-	W	D	-
	LHNCT	6	5	-	-	-	W	-	-	W, S	-	W	D	W, S	W
	LSNKR	6	6	-	-	-	W	-	-	W, S	W	W	W	W, S	-
	PNCHY	6	6	-	-	-	W	-	-	W, S	-	W	W	W, S	W
	SSKNK	5	5	-	W	-	-	-	W	W, S	W, S	-	-	W, S	-
Colusa Glenn (SVWQC)	COLDR	5	5	-	W	-	-	-	W	W	W, S	-	-	W, S	-
	FRSHC	6	6	-	-	-	W	-	-	W, S	W	-	W	W, S	W
	WLKCH	5	0	-	-	-	D	-	-	-	D	D	D	D	-
El Dorado	NRTCN	5	4	-	-	-	-	NS [1]	W	W	W	-	W	-	-
Goose Lake (Goose Lake)	LOWLC	2	2	-	-	-	-	-	W	-	-	W	NS [2]	[2]	-
Lake (SVWQC)	MDLCR	9	6	W	-	-	W	W	W	W	W	D	D	D	-
	MGSLU	6	0	D	-	-	D	D	-	D	-	-	D	D	-
Napa (Napa)	PCULB	6	1	D	-	-	-	-	-	W	D	-	D	D	D
Pit River (NECWA)	PRPIT	7	7	-	-	-	-	-	W	W	W	W	W	W, S	W
PNSSNS (PNSSNS)	CCBRW	5	5	-	-	-	-	-	W, S	-	W	-	W	W, S	W
Sac/Amador (SVWQC)	CRTWN	5	1	-	-	-	-	-	W, S	-	D	D	D	D	-
	GIDLR	5	5	-	-	-	-	-	W, S	-	W	-	W	W, [3]	W
Shasta/Tehama (SVWQC)	ACACR	5	5	-	-	-	-	-	W, S	-	-	W	W	W, S	W
Solano (SVWQC)	UCBRD	8	8	-	W	-	-	W	W	W, S	-	W	W	W, S	W
	SSLIB[3]	5	5	-	W	-	-	-	W	W	W, S	-	-	W, S	-
UFRW (UFRW)	MFFGR	3	3	-	-	-	-	-	W	W	-	-	NS [4]	-	W
Yolo (SVWQC)	WLSPL	7	7	-	-	-	W	-	W, S	W	W	W	W	W, S	-
	Totals	**122**	**96**												

Notes:
NECWA = Northeastern California Watershed Association
PNSSNS = Placer-Nevada-South Sutter-North Sacramento
SVWQC = Sacramento Valley Water Quality Coalition
UFRW = Upper Feather River Watershed Group

W = Water sample collected
S = Sediment sample collected
D = Site was dry; no samples collected.
NS = Planned, but not sampled
"-" = no samples planned

[1] = Not sampled due to unsafe conditions/site inaccessibility
[2] = July sampling event was moved to August due to groundwater being pumped directly into Lassen Creek. August sampling event was not conducted due to exemption of Goose Lake area from ILRP requirements
[3] = Sediment sample not collected due to inaccessible monitoring site
[3] = SSLIB includes areas in both the Solano and Yolo Subwatersheds
[4] = Not sampled, event moved to September

SUMMARY OF SAMPLING CONDITIONS

Samples were collected throughout the year for the Coalition (see **Table 2**, Sampling for the 2021 Coalition Monitoring Year). The Coalition's two sample collection periods include the wet season monitoring period from November 2020 through March 2021 and the irrigation season monitoring period from April 2021 through September 2021. October 2020 is classified as belonging to the irrigation season but is attributed to the previous year's period. Combining the wet season and irrigation seasons of the Coalition's 2021 Monitoring Year corresponds to the same period as the 2021 Water Year (October 2020 to September 2021).

Based on climate data available from the Sacramento Executive Airport weather station, rainfall during the entirety of the 2021 Water Year was at or below average every month (**Table** 8). The water year started dry with zero precipitation recorded in October. The duration of the Coalition's wet season monitoring had below-average precipitation totals every month and conditions remained exceptionally dry with only a few hundredths of an inch of rain recorded during the Coalition's irrigation season. Average monthly temperatures were greater than average for every month except for three (October, November, March). The maximum temperature exceeded 90° on 14 days in October, one day in April, eight days in May, 17 days in June, 26 days in July, 21 days in August, and 15 days in September.

The 2021 Water Year was classified as "Critical" for the Sacramento Valley by the California Department of Water Resources, with an estimated 48% of historic average precipitation compared to previous water year indices.[8] Sacramento River Region unimpaired runoff for the 2021 Water Year was about 6.4 million acre-feet (MAF), or approximately 36% of average.

Regional precipitation patterns for October 2020 through September 2021, as they relate to Coalition monitoring events, are illustrated in **Figure 2-a** through **Figure 2-g**. Compared to the prior water year, fewer precipitation events occurred throughout the year from October to June, resulting in relatively lower flows in Sacramento Valley waterbodies (**Figure 3-a** through **Figure 3-f**). Despite fewer precipitation events, water samples were still collected during the storm season following precipitation events and during the irrigation season.

[8] https://cdec.water.ca.gov/reportapp/javareports?name=WSI

Table 8. Summary of Climate Data[9] at Sacramento Executive Airport, October 2020 – September 2021

Month	Monthly Mean Temperature (deg F)	Departure from Normal Mean Temperature	Days with Maximum Temperature ≥ 90°F	Precipitation Total (Inches)	Departure from Normal Precipitation
October 2020	68.8	-4.3	14	0.00	-0.85
November 2020	52.7	-1.2	0	0.54	-1.12
December 2020	48.2	0.9	0	1.54	-0.93
January 2021	48.7	1.1	0	2.50	-1.16
February 2021	53.9	2.4	0	0.90	-2.59
March 2021	54.1	-1.3	0	1.06	-1.62
April 2021	61.9	2.4	1	0.01	-1.25
May 2021	69.2	3.1	8	0.01	-0.74
June 2021	74.5	2.3	17	0.00	-0.23
July 2021	76.5	0.6	26	0.00	0.00
August 2021	79.5	4.2	21	0.00	-0.04
September 2021	75.8	3.5	15	0.05	-0.04

[9] Preliminary monthly climate data (temperature and precipitation) for Sacramento Executive Airport weather station available at: http://www.weather.gov/climate/index.php?wfo=sto

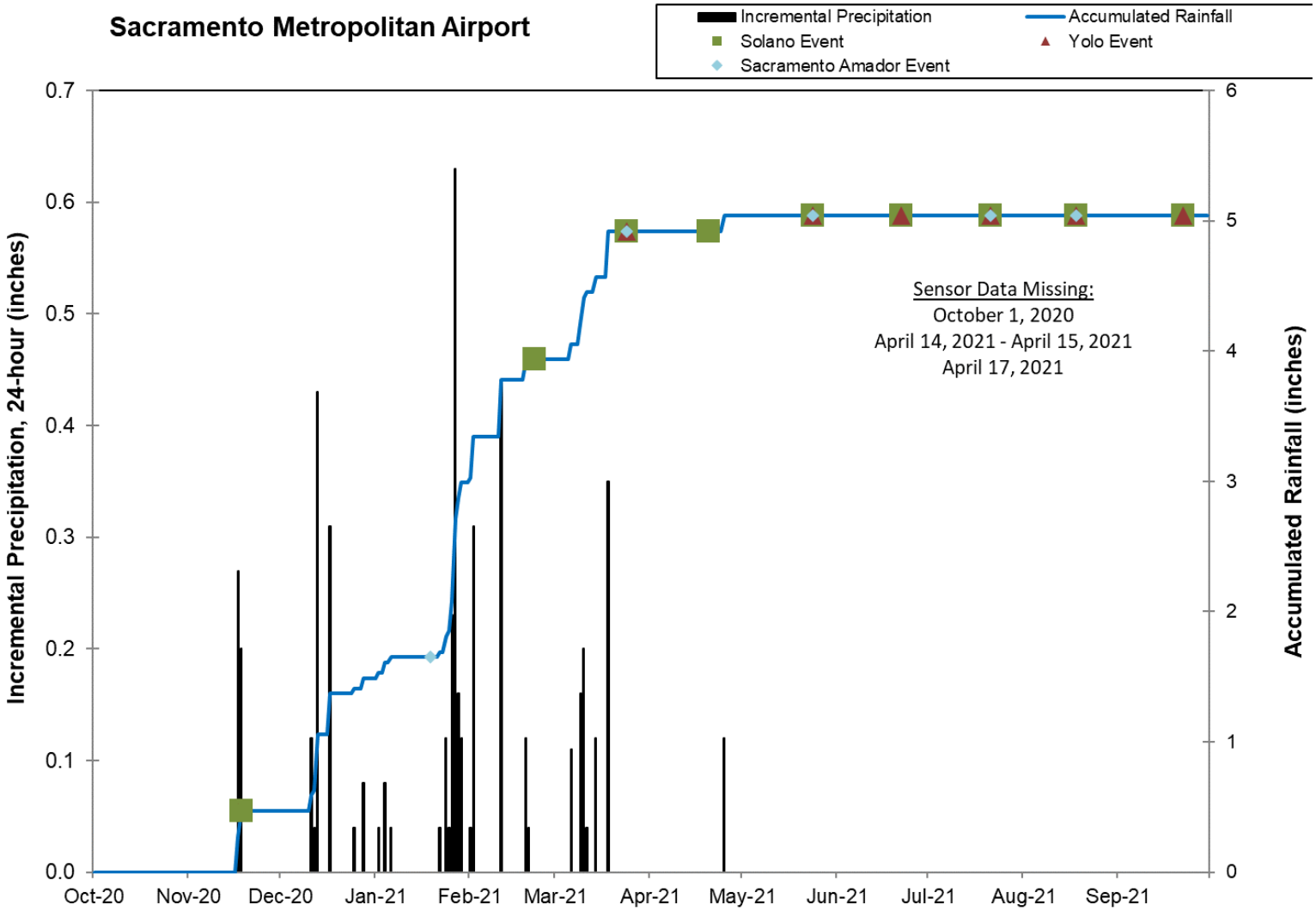

Figure 2-a. Precipitation during 2021 Coalition Monitoring: Lower Sacramento Valley

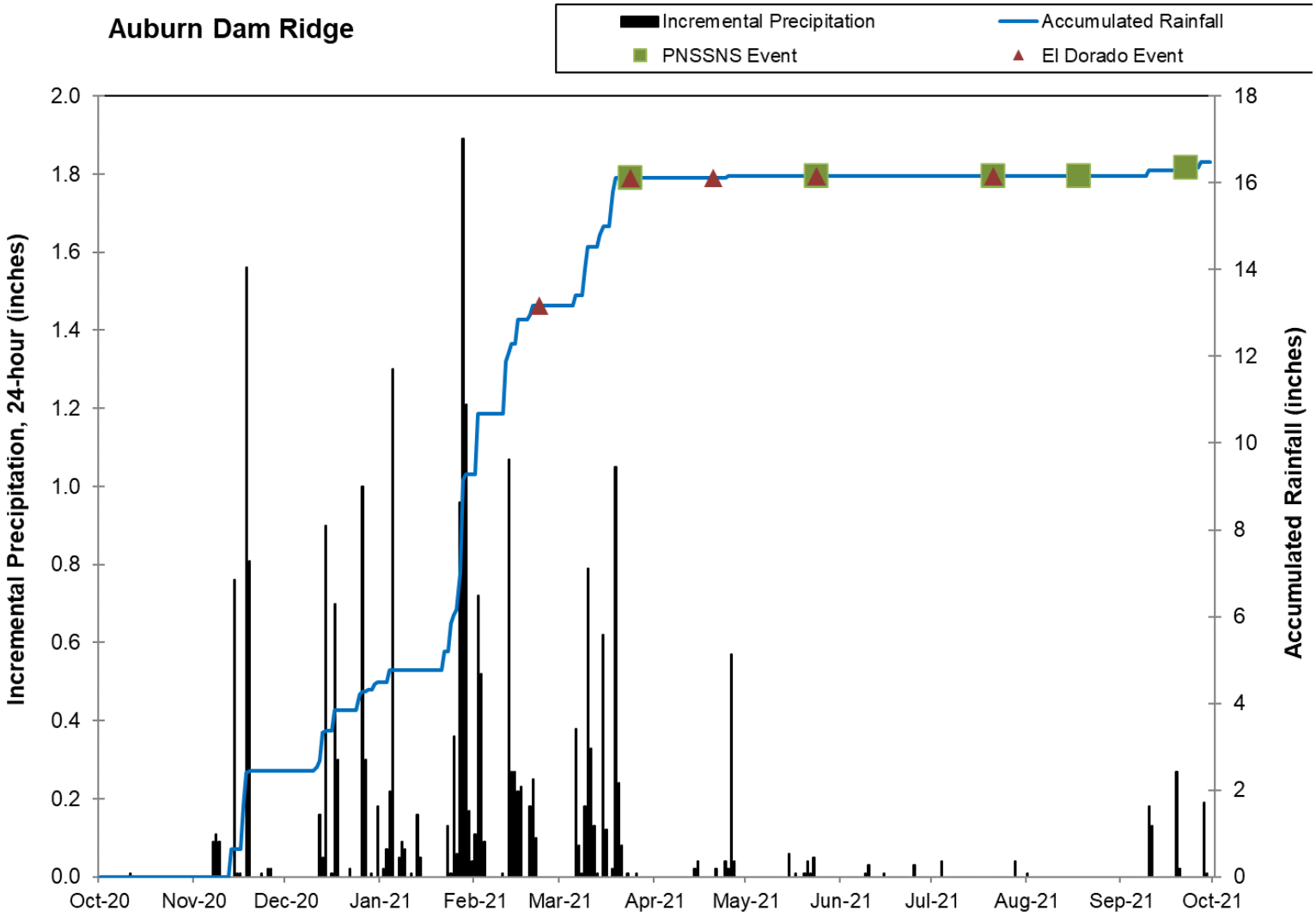

Figure 2-b. Precipitation during 2021 Coalition Monitoring: Sierra Foothills

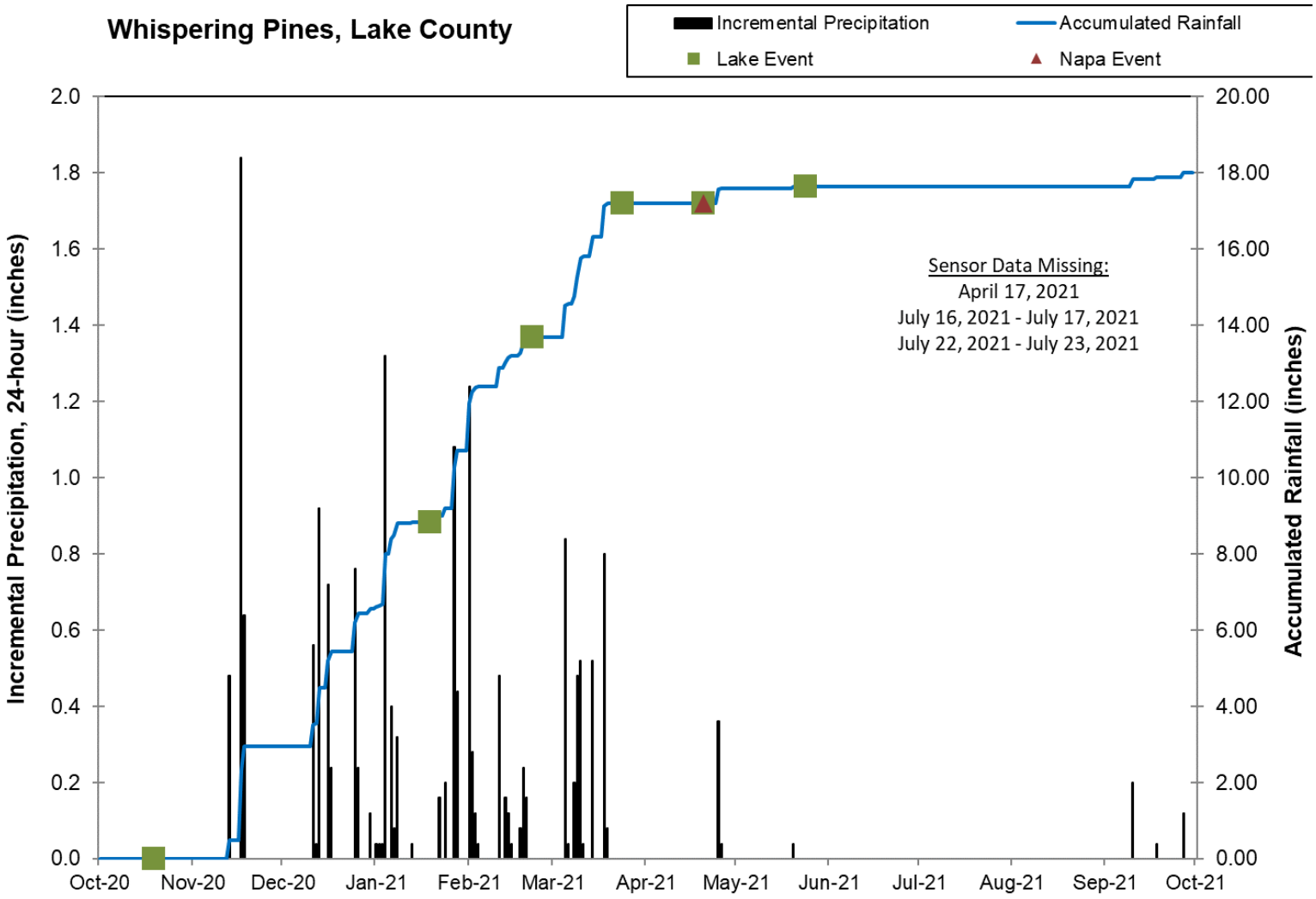

Figure 2-c. Precipitation during 2021 Coalition Monitoring: Lake and Napa Counties

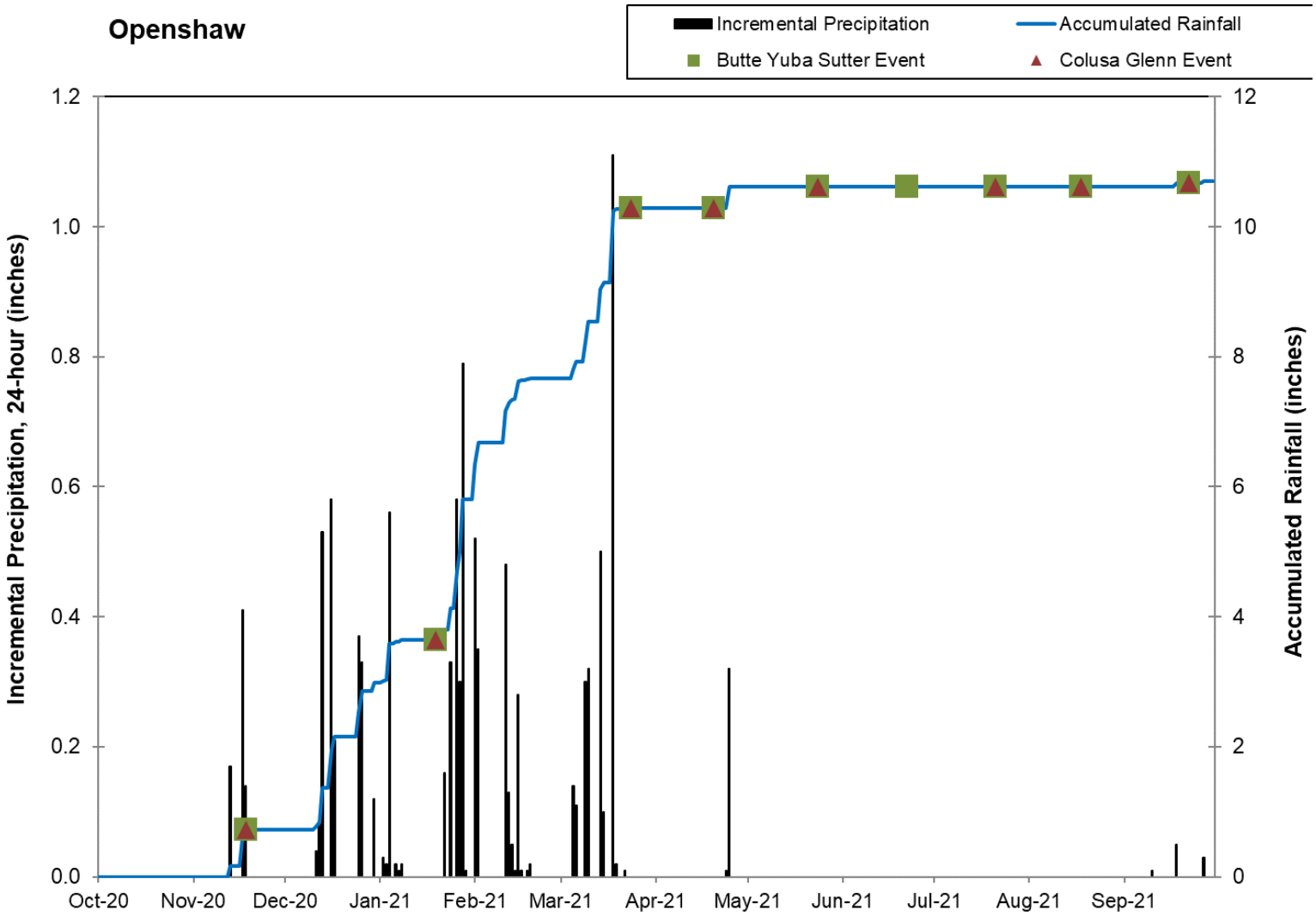

Figure 2-d. Precipitation during 2021 Coalition Monitoring: Central Sacramento Valley

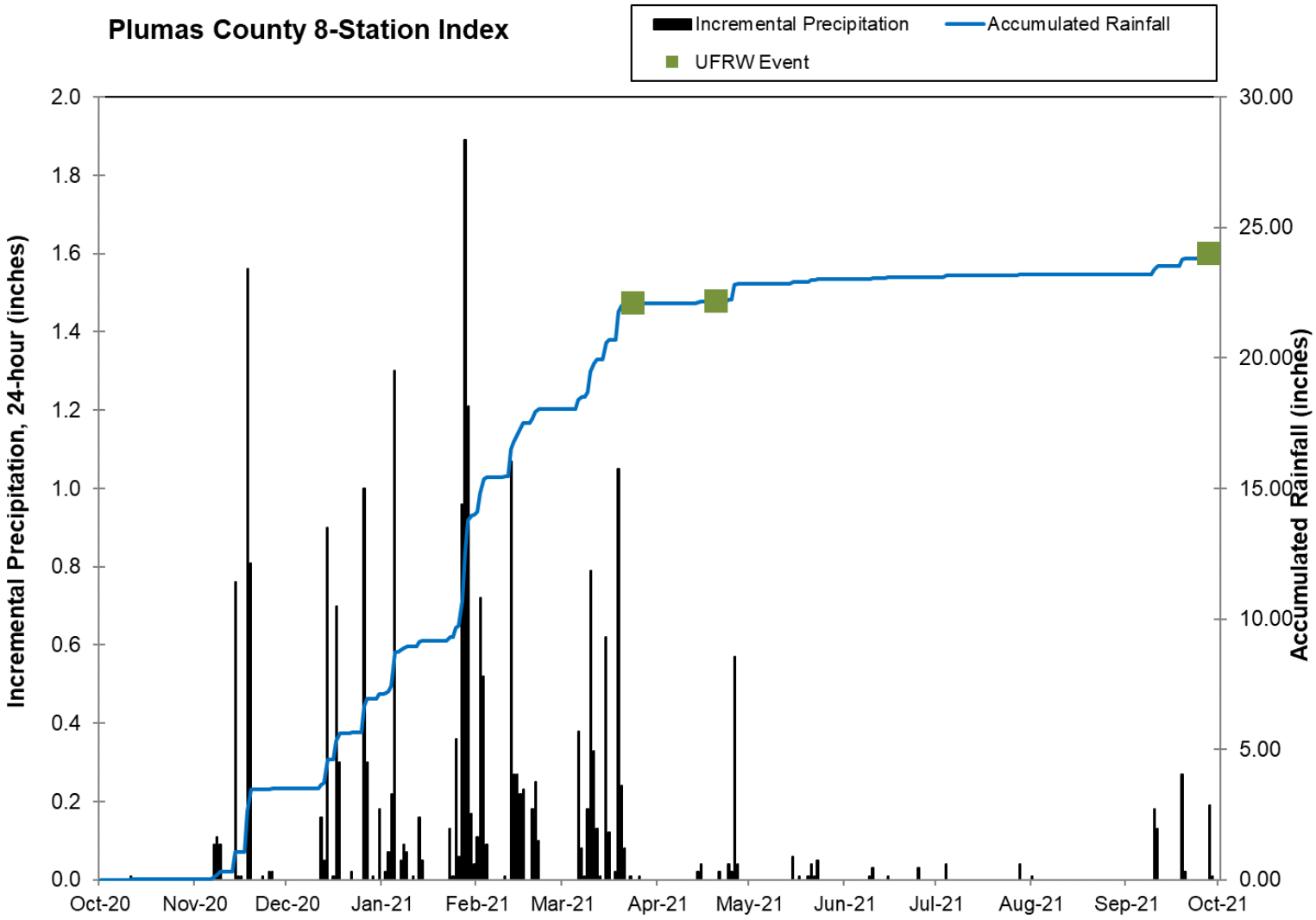

Figure 2-e. Precipitation during 2021 Coalition Monitoring: Plumas County

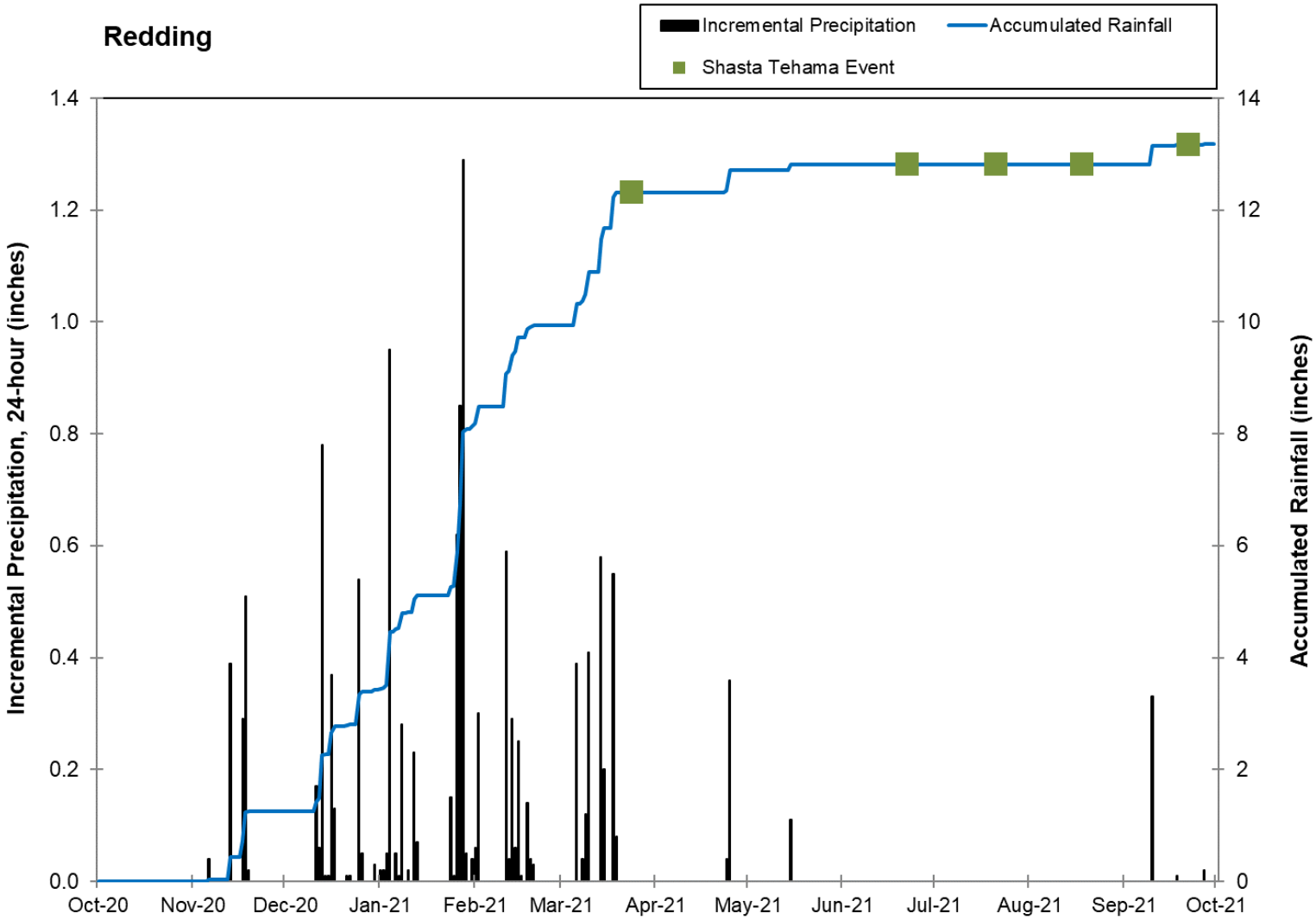

Figure 2-f. Precipitation during 2021 Coalition Monitoring: Upper Sacramento Valley

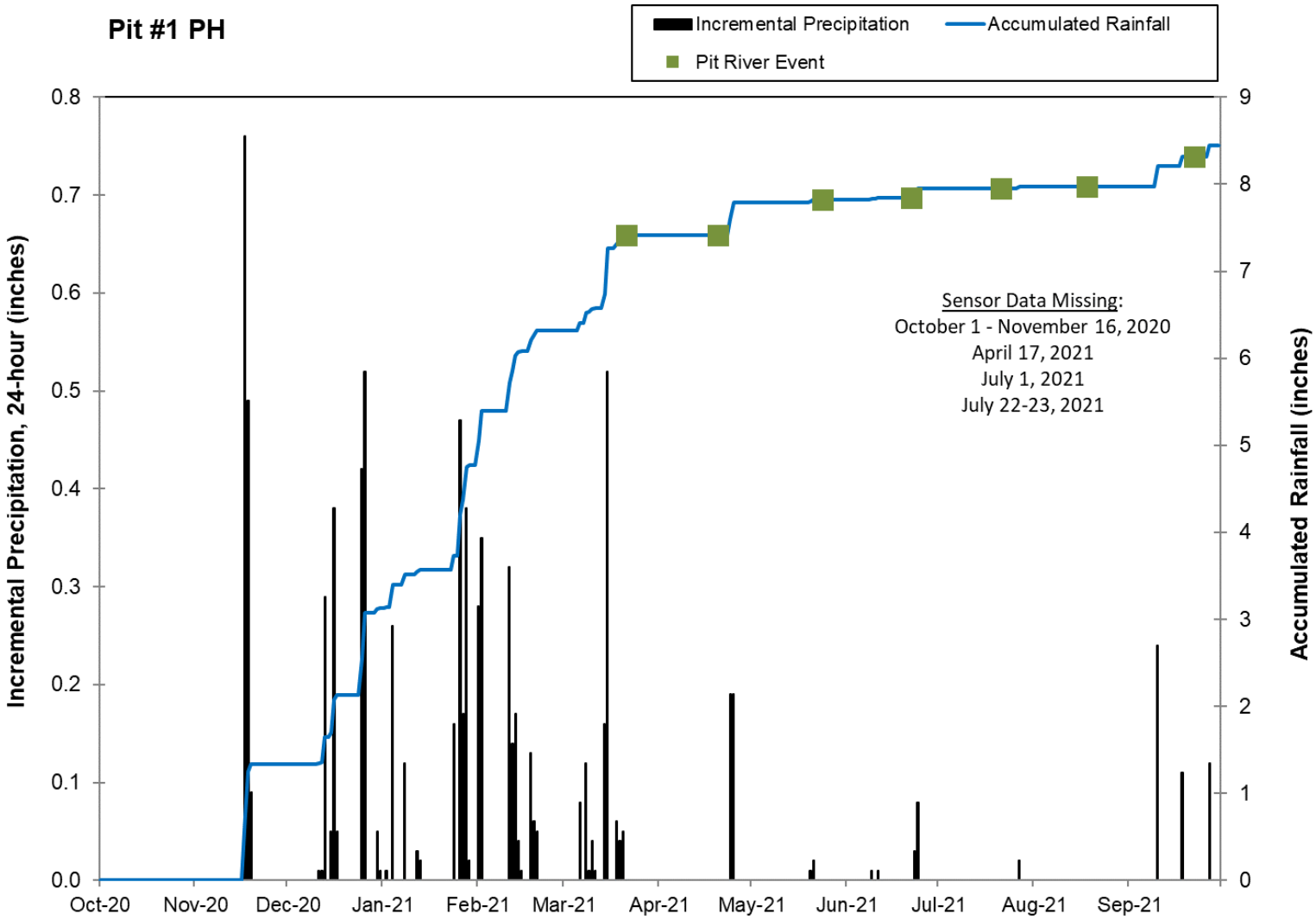

Figure 2-g. Precipitation during 2021 Coalition Monitoring: Pit River

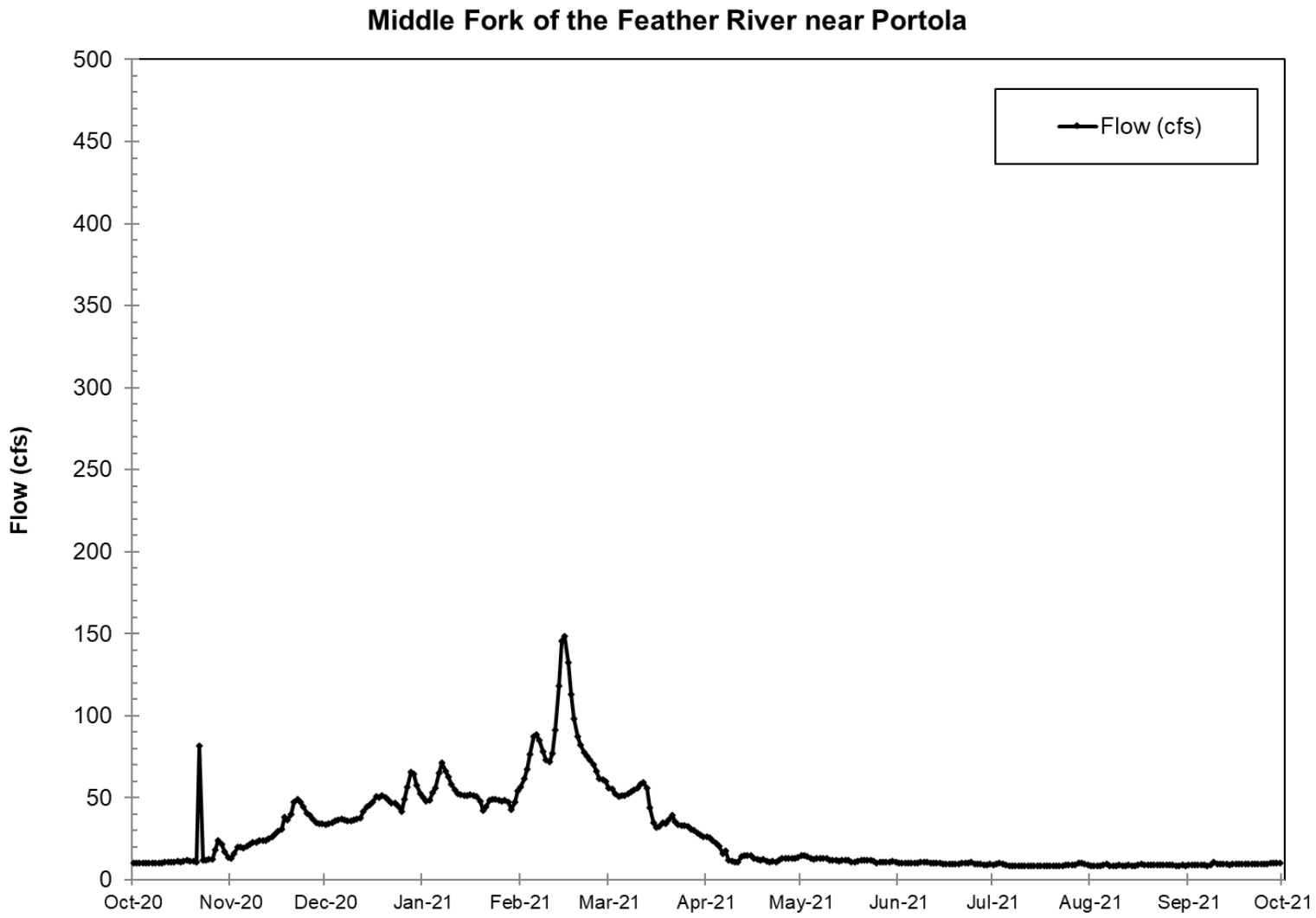

Figure 3-a. Flows during 2021 Coalition Monitoring: Plumas County

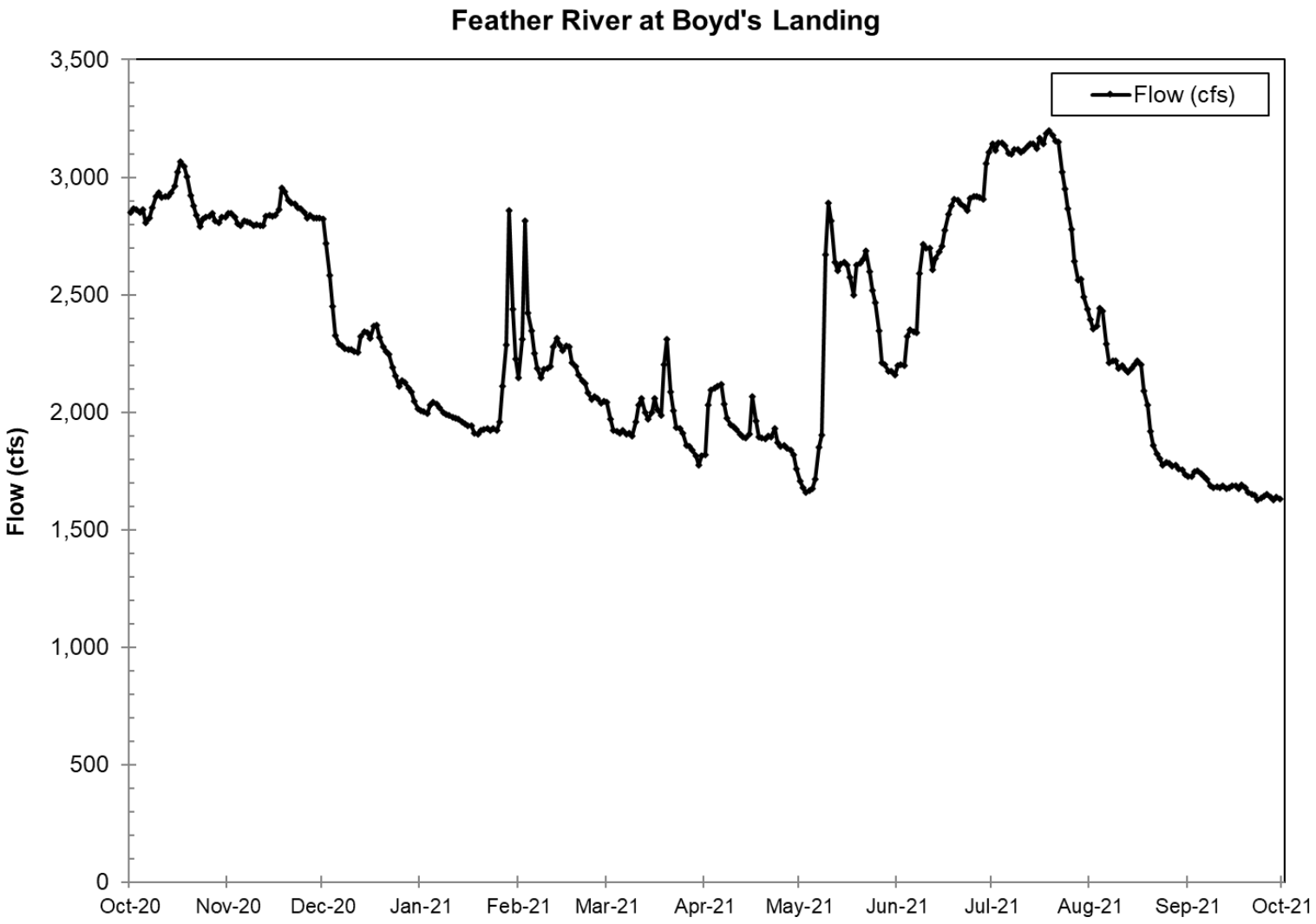

Figure 3-b. Flows during 2021 Coalition Monitoring: East Sacramento Valley

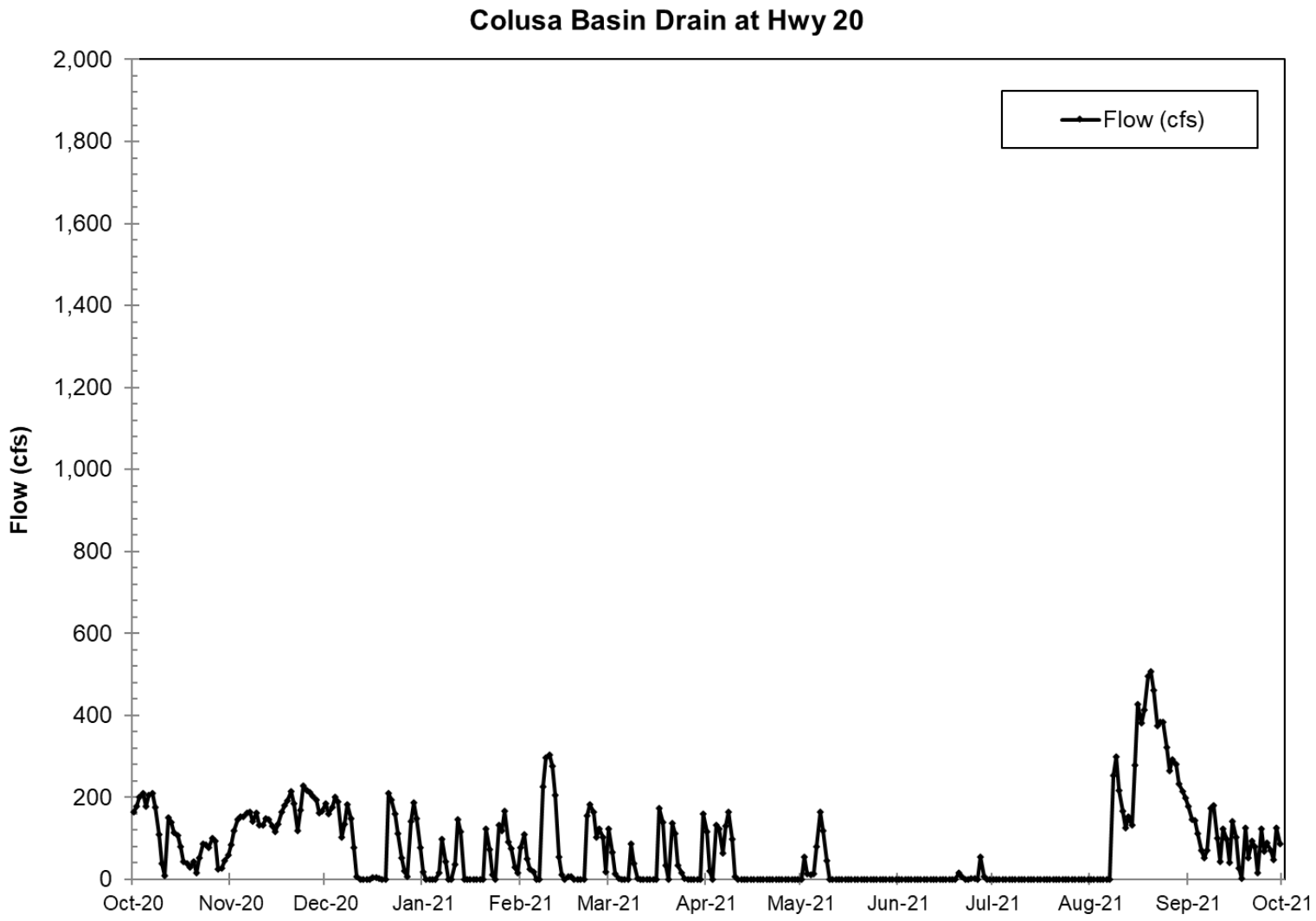

Figure 3-c. Flows during 2021 Coalition Monitoring: West Sacramento Valley

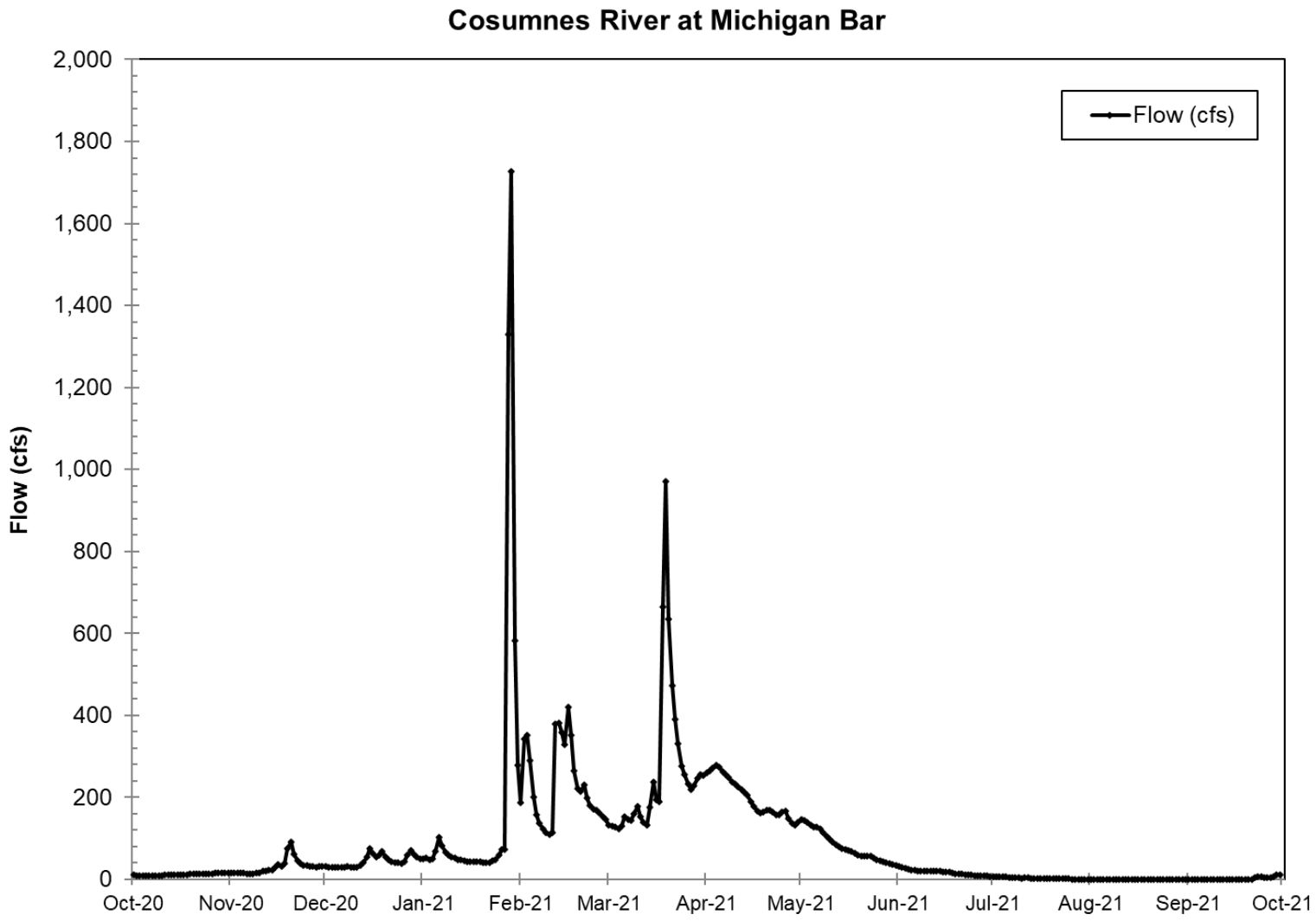

Figure 3-d. Flows during 2021 Coalition Monitoring: Lower Sacramento Valley

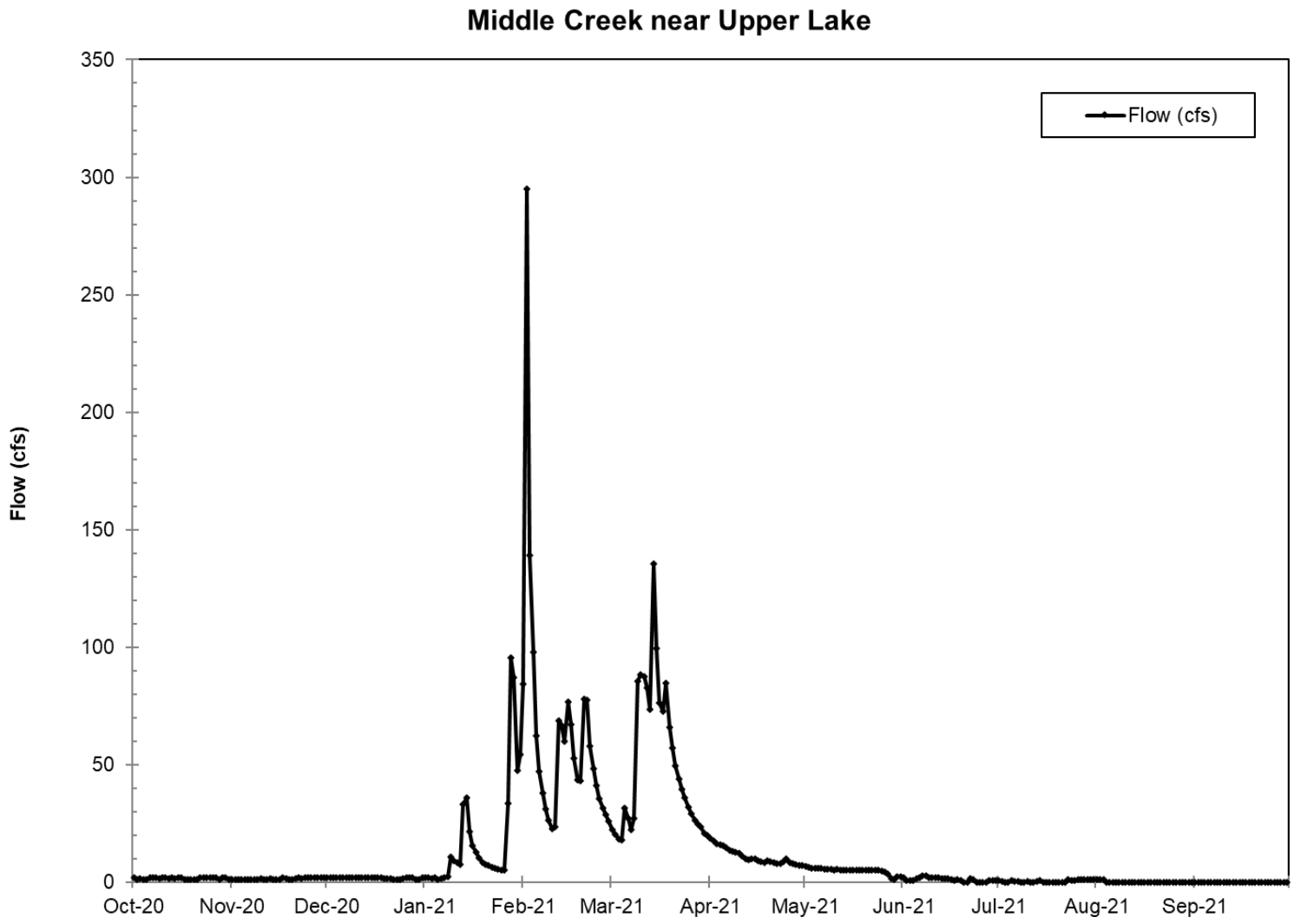

Figure 3-e. Flows during 2021 Coalition Monitoring: Lake County

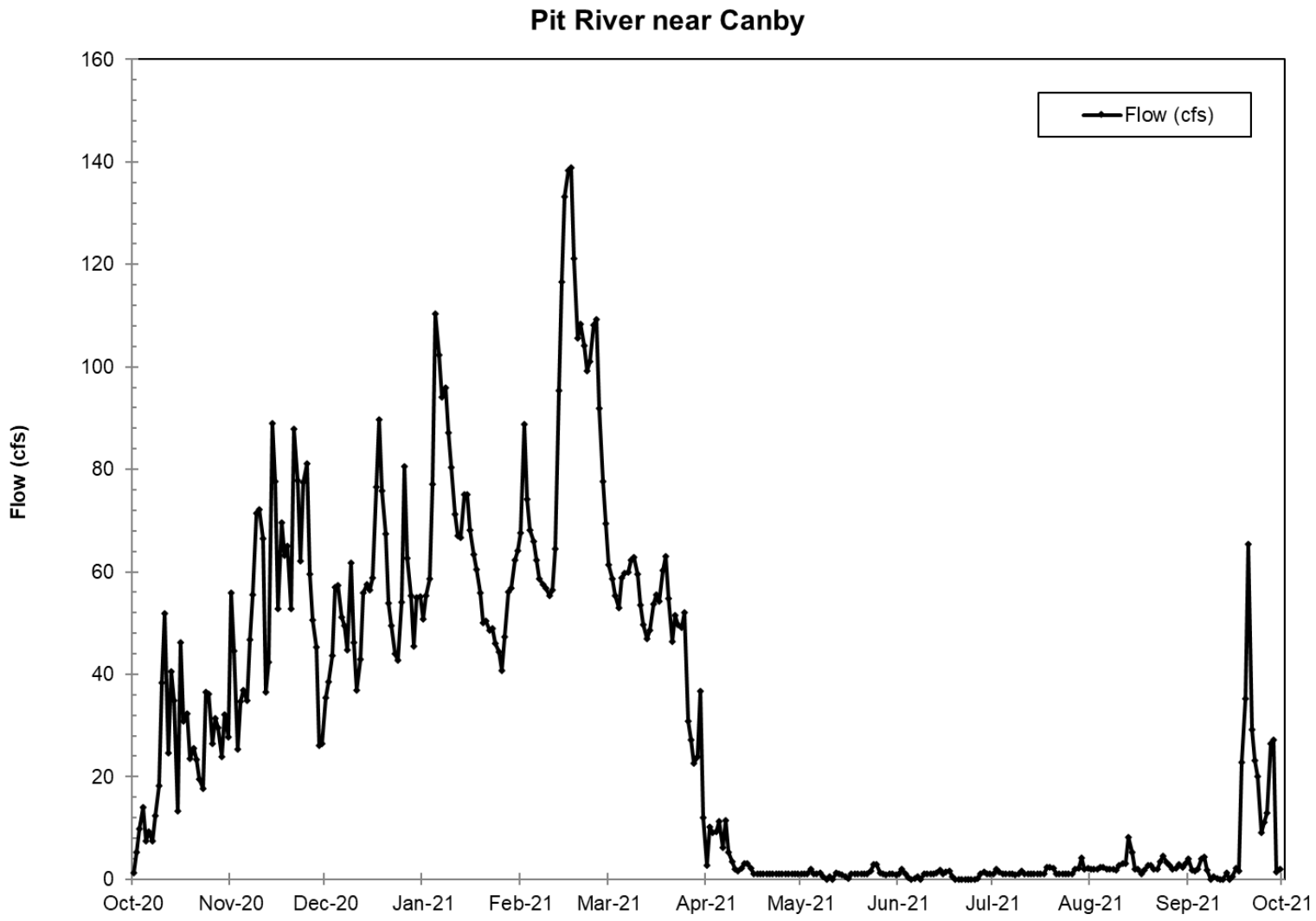

Figure 3-f. Flows during 2021 Coalition Monitoring: Pit River

SAMPLE HANDLING AND CUSTODY

All samples that were collected for the Coalition monitoring effort met the requirements for sample custody. Sample custody must be traceable from the time of sample collection until results are reported. A sample is considered under custody if:

- It is in actual possession;
- It is in view after in physical possession; and
- It is placed in a secure area (i.e., accessible by or under the scrutiny of authorized personnel only after in possession).

The chain-of-custody forms (COCs) for all samples collected by Coalition contractors for the monitoring events conducted from October 2020 through September 2021 are included with the associated lab reports and are provided in **Appendix B**. All COCs for ILRP monitoring conducted by Coalition partners during this same period are also provided in **Appendix B** with their associated lab reports.

Sample containers are occasionally lost or broken in transit due to shipping and handling factors beyond the Coalition's control. Broken containers are relevant to program completeness if the incident prevents the Coalition from completing the required sample analyses or if they are analyzed and may potentially affect analytical quality. In general, broken bottles do not impact the completeness of analyses. In most cases, sufficient remaining sample volume is available to complete the planned environmental and quality assurance analyses. If program completeness was affected, the issue of broken bottles is discussed in this report. The protocol that is followed if a broken bottle is reported is to contact the sampling crew and let them know of the issue so that they may review their packing and shipping procedures. Any known shipping and handling deficiencies are also noted. If samples lost or broken in shipping affect overall completeness for specific analyses at a specific location and the analyses are relevant to synoptically collected toxicity samples, then additional sample volume is preferentially aliquoted from the sample collected for toxicity. If additional sample volume from another appropriately collected and preserved sample container is not available, the analyses are rescheduled for a future event to ensure program completeness objectives are met. Sample containers that were received broken are summarized below:

- Sample shipments for October 2020 through September 2021 monitoring were all received with no broken or damaged bottles.

In addition, sample containers occasionally arrive at the analytical laboratory at a temperature that is above the recommended maximum (6˚C) for Coalition samples. This may occur when samples do not have sufficient time to cool down to the target temperature or when extended shipping times and higher external temperatures cause sample temperatures to increase above 6˚C. This has proven to be a challenge for toxicity samples because the sample volumes are large (1-gallon containers), require additional shipping protection (bubble wrap), and take longer to cool, particularly when ambient water temperatures exceed 25˚C. However, because toxicity tests are typically conducted at ~20˚C over four days, sample temperatures slightly elevated above 6˚C on receipt are not expected to have a significant impact on the toxicity test results. However, all samples received above recommended temperatures are qualified as required (i.e., using the appropriate CEDEN QA Code: *BY = Sample received at improper temperature*). In

each case, the sampling crews are notified and the sample collection conditions and shipping procedures are reviewed in an attempt to determine the cause of the elevated temperatures.

- Sample shipments for October 2020 through September 2021 monitoring were all received at temperatures below 6˚C.

QUALITY ASSURANCE RESULTS

The Data Quality Objectives (DQOs) used to evaluate the results of the Coalition monitoring efforts are described in the Coalition's QAPP. These DQOs are the detailed quality control specifications for precision, accuracy, representativeness, comparability, and completeness. These DQOs are used as comparison criteria during data quality review to determine if the minimum requirements have been met and the data may be used as planned.

Results of Field and Laboratory QA/QC Analyses

Quality Assurance/Quality Control (QA/QC) data are summarized in **Table 9**. All program QA/QC results are included with the lab reports in **Appendix B** of this document, and any qualifications of the data, made by either the analyzing laboratory or the Coalition, are presented with the tabulated monitoring data.

Table 9. Summary of QA/QC Results for 2021 Monitoring Year

Field Blank	Field Duplicate	Method or Lab Blank	Lab Control Spike	Lab Control Spike Duplicate	Matrix Spike	Matrix Spike Duplicate	Lab Duplicate	Surrogate Recovery
97.6%	93.2%	100%	99.3%	99.7%	94.0%	94.6%	100%	94.8%

TABULATED RESULTS OF LABORATORY ANALYSES

Copies of final laboratory reports and all reported QA/QC data for Coalition monitoring results are provided in **Appendix B**. The tabulated results for all validated environmental and QA/QC data are provided in **Appendix C**. These data were previously submitted as part of the Coalition's quarterly data submittals to the ILRP.

Assessment of Water Quality Objectives

Coalition and subwatershed monitoring data were compared to ILRP Trigger Limits. Generally, these trigger limits are based on applicable narrative or numeric water quality objectives in the Central Valley Basin Plan (CVRWQCB, 2018), subsequent adopted Basin Plan Amendments, the California Toxics Rule (USEPA 2000), and numeric interpretations of the Basin Plan narrative objectives. Observed exceedances of the ILRP Trigger Limits are the focus of this discussion.

Other relevant non-regulatory toxicity thresholds were also considered for the purpose of identifying potential causes of observed sediment toxicity. It should be noted that these unadopted, non-regulatory, toxicity thresholds are not appropriate criteria for determining exceedances for the purpose of the Coalition's monitoring program and evaluating compliance with the ILRP. The additional toxicity thresholds were acquired from USEPA's Office of Pesticide Programs (OPP) Ecotoxicity Database (USEPA 2019; online database updated regularly) and the International Union of Pure and Applied Chemistry Pesticide Properties Database (IUPAC PPDB; online database updated regularly).

Water quality objectives and other relevant water quality thresholds discussed in this section are summarized in **Table 10** and **Table 11**. Monitored analytes without relevant water quality objectives or ILRP Trigger Limits are listed in **Table 12**.

The data evaluated for exceedances, as described in this document, include all Coalition collected results, as well as the compiled results from the subwatershed monitoring programs presented in this report, where relevant water quality objectives exist. The results of these evaluations are discussed below.

Table 10. Adopted Basin Plan and California Toxics Rule Objectives for Analytes Monitored for 2021 Coalition Monitoring

Analyte	Most Stringent Objective[1]	Units	Objective Source[2]
Ammonia, Total as N	narrative	mg/L	Basin Plan
Arsenic, total	50	µg/L	CA 1˚ MCL
Atrazine	1	µg/L	CA 1˚ MCL
Chlorpyrifos	0.015	µg/L	Basin Plan
Copper, dissolved	Hardness-dependent[3]	µg/L	CTR
Diazinon	0.10	µg/L	Basin Plan
Dissolved Oxygen	5	mg/L	Basin Plan
Malathion	0.1[4]	µg/L	Basin Plan
Nitrate, as N	10	mg/L	CA 1˚ MCL
pH	6.5-8.5	-log[H+]	Basin Plan
Pyrethroid Pesticides[5]	1 CGU	----	Basin Plan
Temperature	narrative	µg/L	Basin Plan
Toxicity, Algae (*Hyalella*) Survival	narrative	% Survival	Basin Plan
Toxicity, Algae (*Selenastrum*) Cell Density	narrative	% Survival	Basin Plan
Toxicity, Water Flea (*Ceriodaphnia*) Survival	narrative	% Survival	Basin Plan
Turbidity	narrative	NTU	Basin Plan

Notes:

1. For analytes with more than one limit, the most limiting applicable adopted water quality objective is listed.
2. *CA 1º MCLs* are California's Maximum Contaminant Levels for treated drinking water; *CTR* = California Toxics Rule criteria.
3. Objective varies with the hardness of the water.
4. These values are Basin Plan performance goals. The Basin Plan states: "…discharge is prohibited unless the discharger is following a management practice approved by the Board." This has been interpreted as an ILRP Trigger Limit of ND (Not Detected).
5. Pyrethroid pesticides considered in the 2017 Central Valley Pyrethroid Pesticides Total Maximum Daily Load and Basin Plan Amendment (Pyrethroid Pesticide BPA) include the following: bifenthrin, cyfluthrin, cypermethrin, esfenvalerate, lambda-cyhalothrin, and permethrin. The ILRP Trigger Limit for the additive concentration of these six pyrethroid pesticides was compared to Coalition water quality results beginning in April 2019.

Table 11. Unadopted Water Quality Limits Used to Interpret Narrative Water Quality Objectives for Analytes Monitored for 2021 Coalition Monitoring

Analyte	Unadopted Limit[1]	Units	Limit Source
Boron, total	700	µg/L	Ayers and Westcott 1988
Specific Conductivity	700	µS/cm	Ayers and Westcott 1988
Specific Conductivity	900	µS/cm	CA Recommended 2˚ MCL
E. coli [1]	235	MPN/100mL	Basin Plan Amendment
Carbaryl	2.53	µg/L	USEPA NAWQC
Diuron	1	µg/L	USEPA Health Advisory
Methomyl	0.52	µg/L	USEPA NAWQC
Paraquat	3.2	µg/L	USEPA IRIS Reference Dose
Phorate	0.7	µg/L	NAS Health Advisory
Simazine	1	µg/L	1˚ MCL
Trifluralin	5	µg/L	USEPA IRIS Cancer Risk Level

Note:

1. Adopted by the Central Valley Water Board but not approved by the State Water Resources Control Board.

Table 12. Analytes Monitored for 2021 Coalition Monitoring without Applicable Adopted or Unadopted Limits

Analytes		
% Solids	Fenpropathrin	Tau-Fluvalinate
Allethrin	Hardness as CaCO3	Tebuconazole
Chloropicrin	Imidacloprid	Tetramethrin
Chlorothalonil	Orthophosphate, as P	Total Kjeldahl Nitrogen
Cyprodinil	Oxyfluorfen	Total Nitrogen
Deltamethrin	Pendimethalin	Total Organic Carbon
Dichlorophenoxyacetic Acid, 2,4-	Propiconazole	Total Suspended Solids
Discharge (flow)	Pyraclostrobin	
Dissolved Organic Carbon	Pyridaben	

TOXICITY AND PESTICIDE RESULTS

A summary of the toxicity and pesticide results from 2021 Coalition monitoring is provided in this section.

Toxicity Exceedances in Coalition Monitoring

There were 54 individual toxicity results (including 16 field duplicates) for *Selenastrum capricornutum* (35 analyses) and *Ceriodaphnia dubia* (19 analyses) produced from water column samples collected at eight sites during 2021 Coalition monitoring. Toxicity to either species was not observed in any of the samples.

Water column and sediment toxicity bioassays for *Hyalella azteca* were also conducted during the 2021 Coalition monitoring year as required by the Pyrethroid Pesticide BPA. The analyses and any observations of toxicity are included later in this section in the discussion of the Pyrethroid Pesticide BPA baseline monitoring results.

Pesticides Detected in Coalition Monitoring

There were 949 individual pesticide results (including 145 field duplicates) generated from seven sites during 2021 Coalition monitoring. Analyses were conducted for organophosphates, carbamates, organochlorines, insecticides, fungicides, triazines, pyrethroids, and a variety of herbicides. Within these monitored pesticide categories, seven different pesticides were detected out of a total of 66 detected results (including eight field duplicates). Overall, greater than 93% of all pesticide results were below detection for the 2021 Monitoring Year. It should be noted that detections of pesticides are not equivalent to exceedances (with the exceptions of carbofuran, malathion, and methyl parathion which have prohibitions of discharge as per the Basin Plan).

All pesticides detected in water column samples during 2021 Coalition monitoring, except for the six pyrethroid pesticides specified in the Pyrethroid Pesticide BPA (bifenthrin, cyfluthrin, lambda-cyhalothrin, cypermethrin, esfenvalerate, and permethrin), are listed in **Table 13**. Pesticides measured in the water column were compared to relevant numeric and narrative water quality objectives, and in the case of concentrations measured in sediment, to toxicity threshold concentrations published in USEPA's *ECOTOX* Database (USEPA 2019; online database updated regularly) and the International Union of Pure and Applied Chemistry Pesticide Properties Database (IUPAC PPDB; online database updated regularly). It should be noted that no analyses for pesticides in sediment were required during the 2021 Monitoring Year because no sediment toxicity was observed.

Table 13. Pesticides Detected in the Water Column during 2021 Coalition Monitoring

Site	Date	Analyte	Result[1] (µg/L)		Trigger Limit[2]	Basis for Limit[3]
SSKNK	11/18/2020	Deltamethrin/Tralomethrin	DNQ	0.4	NA	NA
COLDR	5/24/2021	Propiconazole	=	0.045	NA	NA
SSKNK	5/24/2021	Deltamethrin /Tralomethrin	DNQ	0.2	NA	NA
SSKNK	5/24/2021	Propiconazole	=	0.02	NA	NA
SSKNK	5/24/2021	Propiconazole[4]	=	0.02	NA	NA
SSLIB	5/24/2021	Propiconazole	DNQ	0.012	NA	NA
COLDR	5/25/2021	Propiconazole	=	0.029	NA	NA
COLDR	5/25/2021	Propiconazole[4]	=	0.029	NA	NA

BOLD = Exceedance

1. "DNQ" (Detected Not Quantified) indicates that the detected value was less than the quantitation or reporting limit (QL).
2. Water Quality Objective or Narrative Interpretation Limits for ILRP. "NA" if no ILRP limit established.
3. Water Quality Objective Basis: BP = Central Valley Basin Plan; BPA = Basin Plan Amendment; Cal/EPA = Cal/EPA Cancer Potency Factor; CDPH Notification Level = Notification levels (formerly called "action levels") are published by the California Department of Public Health (CDPH) for chemicals for which there is no drinking water MCL;
   CTR = California Toxics Rule; Narrative = unadopted limits used to interpret Basin Plan narrative objectives by the Central Valley Water Board; USEPA Health Advisory = Drinking water health advisory.
4. Sample was collected as a field duplicate.

The 2017 Pyrethroid Pesticide BPA established a conditional prohibition of pyrethroid discharges to Central Valley waterbodies at concentrations above specified aquatic life protection-based concentration triggers (prohibition triggers). The prohibition triggers (a chronic pyrethroid trigger and an acute pyrethroid trigger) are not adopted WQOs but do function similarly to an ILRP Trigger Limit in that the pyrethroid triggers are intended to be used to indicate when a pyrethroid management plan needs to be developed. The prohibition trigger for pyrethroid pesticides is based on an additive chronic and additive acute concentration goal unit (CGU) of 1 (a unitless value) as required in the Pyrethroid Pesticide BPA. The additive CGU is calculated using the detected concentrations of six pyrethroid pesticides (bifenthrin, cyfluthrin, lambda-cyhalothrin, cypermethrin, esfenvalerate, and permethrin) specified in the Pyrethroid Pesticide BPA and contemporaneous measurements of particulate organic carbon (POC) and dissolved organic carbon (DOC), where POC concentration is derived from total organic carbon (TOC) concentration minus DOC concentration.

The Pyrethroid Pesticide BPA also requires that agricultural coalitions determine whether pyrethroid pesticides are causing or contributing to the narrative water quality objective for toxicity in surface waters. This assessment is made by running toxicity bioassays with *Hyalella azteca* using both water column and sediment samples collected at the location where a water column sample is analyzed for pyrethroids. With respect to the observance of water column toxicity to *Hyalella azteca*, if concentrations of any of the six target pyrethroids are detected above their individual reporting limits, then the detected pyrethroid is considered to have caused or contributed to the observed toxicity and is considered an exceedance of the prohibition trigger, even if the calculated, additive chronic CGU is less than or equal to 1 (one).

Detections of these six pyrethroids are listed in **Table 14** and are noted where the concentration contributed to an exceedance of the prohibition trigger. A detailed discussion of all pyrethroid pesticide exceedances observed during 2021 Coalition monitoring is provided in the next section.

Table 14. Pyrethroid Pesticides Detected in the Water Column during 2021 Coalition Monitoring

Site	Date	Analyte	Result[(1)] (µg/L)	
COLDR	11/18/2020	Bifenthrin	DNQ	0.4
LHNCT	1/19/2021	Esfenvalerate/Fenvalerate	DNQ	0.6
PNCHY	1/19/2021	Bifenthrin	DNQ	0.4
COLDR	3/24/2021	Bifenthrin	=	0.7
COLDR	3/24/2021	Bifenthrin[(2)]	DNQ	0.4
SSKNK	3/24/2021	Bifenthrin	DNQ	0.3
UCBRD	3/24/2021	Bifenthrin	DNQ	0.4
CCBRW	5/24/2021	Bifenthrin	=	0.6
CCBRW	5/24/2021	Lambda-Cyhalothrin	DNQ	0.4
GIDLR	5/24/2021	Lambda-Cyhalothrin	=	2.2
LSNKR	**5/24/2021**	**Bifenthrin**	**=**	**0.9**
LSNKR	5/24/2021	Esfenvalerate/Fenvalerate	DNQ	0.6
LSNKR	**5/24/2021**	**Lambda-Cyhalothrin**	**=**	**0.5**
NRTCN	5/24/2021	Bifenthrin	DNQ	0.3
COLDR	5/25/2021	Bifenthrin	=	0.5
COLDR	5/25/2021	Lambda-Cyhalothrin	=	0.7
FRSHC	5/25/2021	Bifenthrin	DNQ	0.4
FRSHC	5/25/2021	Lambda-Cyhalothrin	=	0.6
SSKNK	5/25/2021	Bifenthrin	=	0.5
WLSPL	5/25/2021	Bifenthrin	=	0.6
WLSPL	5/25/2021	Lambda-Cyhalothrin	=	0.8
LHNCT	6/22/2021	Lambda-Cyhalothrin	=	1
LSNKR	6/23/2021	Bifenthrin	DNQ	0.3
LSNKR	6/23/2021	Esfenvalerate/Fenvalerate	DNQ	0.9
LSNKR	6/23/2021	Lambda-Cyhalothrin	=	1
UCBRD	**6/23/2021**	**Lambda-Cyhalothrin**	**=**	**18**
WLSPL	6/23/2021	Lambda-Cyhalothrin	=	1
WLSPL	6/23/2021	Lambda-Cyhalothrin[(2)]	=	1
GIDLR	7/21/2021	Lambda-Cyhalothrin	DNQ	0.4
UCBRD	7/21/2021	Bifenthrin	DNQ	0.3
FRSHC	7/22/2021	Bifenthrin	=	0.5
LSNKR	**7/22/2021**	**Bifenthrin**	**=**	**1.1**
LSNKR	7/22/2021	Lambda-Cyhalothrin	DNQ	0.4
PNCHY	7/22/2021	Bifenthrin	=	0.6
WLSPL	7/22/2021	Bifenthrin	=	0.7
CCBRW	**8/18/2021**	**Bifenthrin**	**=**	**1**

Site	Date	Analyte	Result[(1)] (µg/L)	
CCBRW	**8/18/2021**	**Lambda-Cyhalothrin**	**=**	**1.3**
COLDR	8/18/2021	Bifenthrin	=	0.5
LHNCT	8/18/2021	Bifenthrin	=	0.7
LSNKR	**8/18/2021**	**Bifenthrin**	**=**	**1.2**
LSNKR	8/18/2021	Lambda-Cyhalothrin	DNQ	0.4
ACACR	8/19/2021	Bifenthrin	=	0.5
PNCHY	**8/19/2021**	**Bifenthrin**	**=**	**8**
PNCHY	8/19/2021	Bifenthrin[(2)]	=	4
PNCHY	**8/19/2021**	**Cyfluthrin**	**=**	**0.6**
PNCHY	**8/19/2021**	**Esfenvalerate/Fenvalerate**	**=**	**4.5**
PNCHY	8/19/2021	Esfenvalerate/Fenvalerate[(2)]	=	2
PNCHY	**8/19/2021**	**Lambda-Cyhalothrin**	**=**	**1.4**
PNCHY	8/19/2021	Lambda-Cyhalothrin[(2)]	=	0.7
UCBRD	8/19/2021	Lambda-Cyhalothrin	DNQ	0.3
WLSPL	8/19/2021	Bifenthrin	=	1.5
WLSPL	8/19/2021	Lambda-Cyhalothrin	=	0.7
CCBRW	9/22/2021	Lambda-Cyhalothrin	=	0.9
LHNCT	**9/22/2021**	**Bifenthrin**	**=**	**2.8**
PNCHY	**9/22/2021**	**Bifenthrin**	**=**	**2.4**
PNCHY	**9/22/2021**	**Lambda-Cyhalothrin**	**=**	**1.5**
PNCHY	9/22/2021	Permethrin	DNQ	11

BOLD = Contributed to exceedance of the Pyrethroid Pesticide BPA prohibition trigger

1. "DNQ" (Detected Not Quantified) indicates that the detected value was less than the quantitation or reporting limit (QL).
2. Sample was collected as a field duplicate.

PYRETHROID PESTICIDE EXCEEDANCES

The Coalition implemented the 12 months of pyrethroid pesticide baseline monitoring as required by the Pyrethroid Pesticide BPA during the 2021 Monitoring Year. The baseline monitoring requirement paired water column pyrethroid pesticide analyses for bifenthrin, cyfluthrin, cypermethrin, esfenvalerate, lambda-cyhalothrin, and permethrin with water column *Hyalella azteca* toxicity tests at representative monitoring sites. Twice annual *Hyalella azteca* sediment tests were also required by the baseline monitoring, which is comparable to the assessment year sediment toxicity testing requirements included in the Coalition's WDR.

Water Column Pyrethroid Pesticides and *Hyalella azteca* Toxicity

A summary of the exceedances of the Pyrethroid Pesticide BPA prohibition trigger and associated water column *Hyalella azteca* toxicity from the 2021 baseline monitoring is provided in this section. There was a total of 66 pyrethroid pesticide samples collected across 16 monitoring sites. In eight of these samples, the summed detected concentrations of the six target pyrethroid pesticides exceeded one or both prohibition triggers. Additionally, there were 76 *Hyalella azteca* water column toxicity bioassays (including 9 field duplicates), 14 of which (including 2 field duplicates) were found to be toxic. Five of these toxic samples were linked to

pyrethroids through a comparison of the paired water column pyrethroid analyses. Agricultural Pesticide Use Report (PUR) data for the six weeks prior to an exceedance were reviewed temporally and geographically to determine whether there were any pyrethroid pesticide applications within the drainage that could have caused or contributed to either the exceedance of the pyrethroid pesticide prohibition trigger or the observed toxicity to *Hyalella azteca*. Non-agricultural PUR data were also reviewed, but non-agricultural PUR data are only reported at the county level on a monthly basis, so it is difficult to link non-agricultural applications to a specific exceedance. A summary of the pyrethroid pesticide and *Hyalella azteca* exceedances is listed in **Table 15** and discussed below by monitoring site.

Table 15. Water Column Pyrethroid Pesticide and *Hyalella azteca* Toxicity Results Contributing to Exceedances of the Prohibition Trigger during 2021 Coalition Monitoring

Site	Date	Pyrethroid Pesticide Chronic and Acute CGU	Water Column Hyalella Azteca (% control)
ACACR	3/24/2021	≤1 [chronic]	**63.1**
CCBRW	8/18/2021	**2 [chronic]**	100
CRTWN	3/24/2021	≤1 [chronic]	**35.7**
GIDLR	7/21/2021	≤1 [chronic]	**83.3**
LHNCT	9/22/2021	**3 [chronic]**	**6.7**
LSNKR	5/24/2021	**2 [chronic]**	96.7
LSNKR	7/22/2021	**2 [chronic]**	**73.3**
LSNKR	8/18/2021	**2 [chronic]**	**90**
MDLCR	3/24/2021	≤1 [chronic]	**51.8**
PNCHY	7/22/2021	**≤1 [chronic]**[1]	**90**
PNCHY	8/19/2021	**10 [chronic]**, **2 [acute]**	100
PNCHY	9/22/2021	**3 [chronic]**	**83.3**
PRPIT	3/24/2021	≤1 [chronic]	**82.7**
PRPIT	7/21/2021	≤1 [chronic]	**70**
SSKNK	3/24/2021	≤1 [chronic]	**70.4**
UCBRD	6/23/2021	**5 [chronic]**, **2 [acute]**	**0**

BOLD = Pyrethroid BPA prohibition trigger or observed toxicity to water column *Hyalella azteca*

1. The July 22, 2021, *Hyalella azteca* toxicity result was found to be toxic. The paired water column pyrethroid sample had a detected bifenthrin concentration (0.6 ng/L) and therefore, the toxicity exceedance was considered an exceedance of the prohibition trigger as per Central Valley Water Board staff.

Anderson Creek

In a water column toxicity test conducted with *Hyalella azteca* using a sample collected at the ACACR site on March 24, 2021, the Coalition observed toxicity with test organism survival of 63.1 % as compared to the control. All pyrethroid pesticides analyzed in the paired chemistry sample were found to be non-detect. PUR data within the ACACR drainage for the six weeks prior to the observed toxicity exceedance showed no agricultural applications of pyrethroid pesticides. Additionally, there were no other non-pyrethroid insecticide applications by irrigated agriculture that likely would have caused the toxicity. Non-agricultural PUR data show that there were insecticide applications within Shasta County, but it is difficult to link these applications to

the exceedance, given the lack of detailed temporal and geographic information provided for non-agricultural pesticide applications. Based on the PUR data, lack of pyrethroid pesticide detections, and the lack of additional information, the observed toxicity should not be linked to agricultural use of pyrethroid pesticides.

Coon Creek

A water column pyrethroid pesticide sample collected at the CCBRW site on August 18, 2021, exceeded the chronic prohibition trigger (chronic CGU = 2). The paired *Hyalella azteca* water column test did not exhibit toxicity. Bifenthrin (1.0 ng/L) and lambda-cyhalothrin (1.3 ng/L) were both detected above their reporting limits and factored into the exceedance of the prohibition trigger. PUR data within the CCBRW drainage for the six weeks prior to the exceedance showed no agricultural applications of pyrethroid pesticides that could have caused or contributed to the exceedance. There were numerous Sutter and Placer County non-agricultural applications of bifenthrin and lambda-cyhalothrin applications in July and August, but it is difficult to link these applications to the exceedance, given the lack of detailed temporal and geographic information provided for non-agricultural pesticide applications. Based on the PUR data and the lack of additional information, the exceedance should not be linked to agricultural use of pyrethroid pesticides.

Cosumnes River

In a water column toxicity test conducted with *Hyalella azteca* using a sample collected at the CRTWN site on March 24, 2021, the Coalition observed toxicity with test organism survival of 35.7% as compared to the control. All pyrethroid pesticides analyzed in the paired chemistry sample were found to be non-detect. PUR data within the CRTWN drainage for the six weeks prior to the observed toxicity exceedance showed no agricultural or non-agricultural applications of pyrethroid pesticides. Additionally, there were no other non-pyrethroid insecticide applications by irrigated agriculture that likely would have caused the toxicity. Non-agricultural PUR data show that there were insecticide applications within Sacramento County in February and March, but it is difficult to link these applications to the exceedance, given the lack of detailed temporal and geographic information provided for non-agricultural pesticide applications. Based on the PUR data, lack of pyrethroid pesticide detections, and the lack of additional information, the observed toxicity should not be linked to agricultural use of pyrethroid pesticides.

Grand Island Drain

In a water column toxicity test conducted with *Hyalella azteca* using a sample collected at the GIDLR site on July 21, 2021, the Coalition observed toxicity with test organism survival of 83.3% as compared to the control. Lambda-cyhalothrin was reported as DNQ (Detected Not Quantifiable), but all other pyrethroid pesticides analyzed in the paired chemistry sample were found to be non-detect. It should be noted that the Pyrethroid Pesticide BPA does not require the consideration of pyrethroids reported as DNQ when summing the additive effects of pyrethroid concentrations detected above reporting limits. A review of the PUR data showed that lambda-cyhalothrin had been ground applied to 556 acres of tomatoes and 90 acres of uncultivated agriculture in the six weeks prior to the exceedance. Non-agricultural PUR data show that there were insecticide applications, including pyrethroid pesticide applications within Sacramento

County in June and July, but it is difficult to link these applications to the exceedance, given the lack of detailed temporal and geographic information provided for non-agricultural pesticide applications. Based on the lack of pyrethroid pesticides detected above reporting limits and the lack of additional information, the observed toxicity should not be linked to agricultural use of pyrethroid pesticides.

Lower Honcut Creek

A water column sample collected at the LHNCT site on September 22, 2021, exceeded the chronic prohibition trigger (chronic CGU = 3). The paired *Hyalella azteca* water column toxicity test exhibited test organism survival of 6.7% as compared to the control and was determined to be toxic. Bifenthrin (2.8 ng/L) was detected in the LHNCT sample above its reporting limit and is believed to have caused or contributed to the exceedance of the prohibition trigger. All other pyrethroid pesticides were non-detect. A review of the PUR data showed that bifenthrin had been applied to 1,825 acres of walnut in the six weeks prior to the exceedance. Most of these applications were made aerially (1,663 acres), but there were 161 acres where bifenthrin was ground applied. Non-agricultural applications of bifenthrin in Butte and Yuba counties during August and September 2021 were numerous and primarily applied for structural pest control purposes. However, given the lack of detailed temporal and geographic information provided for non-agricultural pesticide applications, it is difficult to exclusively link these applications to the observed exceedance of the prohibition trigger.

Lower Snake River

Water column samples collected at the LSNKR site on May 24, July 22, and August 18, 2021, exceeded the chronic prohibition trigger. All three samples had calculated chronic CGUs equal to 2. The paired *Hyalella azteca* water column test was not found to be toxic in the May sample (96.7 % survival compared to control), but both the July and August samples were found to be toxic with survival rates of 73.3% and 90% as compared to the control, respectively.

- The May 24, 2021, water sample contained concentrations of bifenthrin (1.1 ng/L) and lambda-cyhalothrin (0.5 ng/L) that were both detected above their reporting limits and factored into the exceedance of the prohibition trigger. Esfenvalerate was reported as DNQ and the remaining pyrethroid pesticides were all non-detect. A review of the PUR data showed that bifenthrin had been ground applied to 72 acres of walnut, 35 acres of almond, and 8 acres of pistachio in the six weeks prior to the exceedance. Lambda-cyhalothrin was applied to 4,990 acres of rice, 1,231 acres of peach, and 441 acres of walnut. All of the lambda-cyhalothrin applications to rice were made aerially, as was a single 22-acre aerial application to walnut. The remaining lambda-cyhalothrin applications to walnut and peach were ground applied. During April and May 2021, non-agricultural applications of pyrethroid pesticides in Sutter County were numerous, with bifenthrin applications (60) occurring almost three times more frequently than lambda-cyhalothrin applications (22). Both pyrethroids primarily were applied for structural pest control purposes.
- The July 22, 2021, water sample contained a concentration of bifenthrin (0.9 ng/L) that was detected above its reporting limit and factored into the exceedance of the prohibition trigger. Lambda-cyhalothrin was reported as DNQ and the remaining pyrethroid

pesticides were all non-detect. A review of the PUR data showed that bifenthrin had been applied to 1,517 acres of almond and 851 acres of walnut in the six weeks prior to the exceedance. All of these applications were ground applied. During June and July 2021, non-agricultural bifenthrin applications (62) in Sutter County primarily were made for structural pest control purposes.

- The August 18, 2021, water sample contained a concentration of bifenthrin (1.2 ng/L) that was detected above its reporting limit and factored into the exceedance of the prohibition trigger. Lambda-cyhalothrin was reported as DNQ and the remaining pyrethroid pesticides were all non-detect. A review of the PUR data showed that bifenthrin had been applied to 879 acres of almond and 245 acres of walnut in the six weeks prior to the exceedance. All of these applications were ground applied. During July and August 2021, non-agricultural bifenthrin applications (54) in Sutter County primarily were made for structural pest control purposes.

Middle Creek

In a water column toxicity test conducted with *Hyalella azteca* using a sample collected at the MDLCR site on March 24, 2021, the Coalition observed toxicity with test organism survival of 51.8% as compared to the control. All pyrethroid pesticides analyzed in the paired chemistry sample were found to be non-detect. PUR data within the MDLCR drainage for the six weeks prior to the observed toxicity exceedance showed no agricultural or non-agricultural applications of pyrethroid pesticides. Based on the PUR data, lack of pyrethroid pesticide detections, and the lack of additional information, the observed toxicity should not be linked to agricultural use of pyrethroid pesticides.

Pine Creek

Water column samples collected for three events at the PNCHY site either exceeded the pyrethroid prohibition trigger or in one case, *Hyalella azteca* toxicity was observed in the presence of a bifenthrin concentration detected above its reporting limit and assumed to cause or contribute to the observed toxicity. The observed *Hyalella* toxicity was considered equivalent to an exceedance of the prohibition trigger. The first of these three exceedances was observed on July 22, 2021, when a *Hyalella azteca* water column test exhibited test organism survival of 90% as compared to the control and bifenthrin was detected above its reporting limit. A water column pyrethroid pesticide sample on August 19, 2021, exceeded the chronic and acute prohibitiontrigger (chronic CGU = 10, acute CGU = 2). Despite the exceedance of the prohibition trigger, there was no observed toxicity (100% survival of test organism compared to the control) in the paired *Hyalella azteca* sample. A September 22, 2021, water column sample exceeded the chronic prohibition trigger (chronic CGU = 3) and the paired *Hyalella azteca* water column test was found to be toxic with an observed test organism survival of 83.3% as compared to the control.

- The July 22, 2021, water sample contained bifenthrin (0.6 ng/L) detected above its reporting limit and all other pyrethroid pesticides reported as non-detect. The detected bifenthrin concentration was not sufficient to exceed the chronic prohibition trigger, but the presence of the pyrethroid in combination with the observed *Hyalella* toxicity was determined to be an exceedance of the prohibition trigger. A review of the PUR data

showed that bifenthrin had been ground applied to 1,517 acres of almond and 851 acres of walnut in the six weeks prior to the exceedance. During June and July 2021, non-agricultural bifenthrin applications (59) in Butte County were made for structural pest control and landscape maintenance purposes.

- The August 19, 2021, water sample contained concentrations of bifenthrin (8 ng/L), cyfluthrin (0.6 ng/L), esfenvalerate (4.5 ng/L), and lambda-cyhalothrin (1.4 ng/L) detected above their reporting limits and collectively resulted in an exceedance of the prohibition trigger. The other pyrethroid pesticides, cypermethrin and permethrin, were reported as non-detect. A review of the PUR data showed that there were no agricultural applications of cyfluthrin made in the six weeks prior to the exceedance, but bifenthrin, esfenvalerate, and lambda-cyhalothrin were all applied. Bifenthrin was ground applied to 9,030 acres of almond, 313 acres of pistachio, and 171 acres of walnut. Esfenvalerate was ground applied to 2,375 acres of almond and 130 acres of walnut. Aerial applications of esfenvalerate were also made to 215 acres of beans. Lambda-cyhalothrin was ground applied to 1,657 acres of walnut, 1,146 acres of almond, and 40 acres of pistachio. During July and August 2021, non-agricultural applications of three of the pyrethroid pesticides (bifenthrin, esfenvalerate, and lambda-cyhalothrin) noted above in Butte County were numerous, with bifenthrin applications (69) occurring over four times more frequently than lambda-cyhalothrin (16) or esfenvalerate (7) applications. All pyrethroids primarily were applied for structural pest control purposes with some application of bifenthrin for landscape maintenance.
- The September 22, 2021, water sample contained concentrations of bifenthrin (2.4 ng/L), lambda-cyhalothrin (1.5 ng/L), and permethrin (11 ng/L) detected above their reporting limits and collectively resulted in an exceedance of the prohibition trigger. The three other target pyrethroid pesticides were reported as non-detect. A review of the PUR data showed that there were agricultural applications of bifenthrin, lambda-cyhalothrin, and permethrin made in the six weeks prior to the exceedance. Bifenthrin was applied to 1,499 acres of walnut, 48 acres of pistachio, and 36 acres of almond. Lambda-cyhalothrin was applied to 6,928 acres of almond and 220 acres of pistachio. Permethrin was applied to 457 acres of walnut and 454 acres of pistachio. A majority of the acreage received these pyrethroid pesticide applications by air (8,211 acres), with the remaining acreage (1,431 acres) receiving applications on the ground. During August and September 2021, non-agricultural applications of the three pyrethroid pesticides noted above in Butte County were numerous, with bifenthrin applications (74) occurring over three times more frequently than lambda-cyhalothrin (20) or permethrin (21) applications. All pyrethroids primarily were applied for structural pest control purposes with some application of bifenthrin for landscape maintenance and permethrin for public health purposes.

Pit River

In water column toxicity tests conducted with *Hyalella azteca* using a sample collected at the PRPIT site on March 24 and July 21, 2021, the Coalition observed toxicity with test organism survival of 82.7% and 70% as compared to the control, respectively. All pyrethroid pesticides analyzed in the paired chemistry samples were found to be non-detect. PUR data within the PRPIT drainage for the six weeks prior to the observed toxicity exceedances showed that cyfluthrin was applied to 60 acres of timothy and alfalfa prior to the March sampling event and

lambda-cyhalothrin was applied to 602 acres of forage hay and 150 acres of orchard grass prior to the July event. Non-agricultural PUR data show that there were various insecticides, including pyrethroid pesticide, applied in Shasta County in the months prior to the observed toxicity (February–March, and June–July), but it is difficult to link these applications to the exceedances given the lack of detailed temporal and geographic information provided for non-agricultural pesticide applications. Based on the lack of pyrethroid pesticides detected above their reporting limits and the lack of additional information, the observed toxicity should not be linked to agricultural use of pyrethroid pesticides.

Sacramento Slough

In a water column toxicity test conducted with *Hyalella azteca* using a sample collected at the SSKNK site on March 24, 2021, the Coalition observed toxicity with test organism survival of 70.4% as compared to the control. Bifenthrin was reported as DNQ and so was the non-TMDL pyrethroid pesticide, deltamethrin. All other pyrethroid pesticides analyzed in the paired water sample were reported as non-detect. PUR data within the SSKNK drainage for the six weeks prior to the observed toxicity exceedances showed that bifenthrin was only applied to 0.1 acres of greenhouse plants, cypermethrin was applied to 40 acres of alfalfa, cyfluthrin was applied to 12 acres of greenhouse plants and 4 acres of deciduous trees, and lambda-cyhalothrin was applied to 223 acres of alfalfa and 120 acres of almonds prior to the March sampling event. Non-agricultural PUR data show that there were various insecticides, including pyrethroid pesticide, applied in Sutter County in February and March, but it is difficult to link these applications to the exceedance given the lack of detailed temporal and geographic information provided for non-agricultural pesticide applications. Based on the lack of pyrethroid pesticides detected above their reporting limits and the lack of additional information, the observed toxicity should not be linked to agricultural use of pyrethroid pesticides.

Ulatis Creek

A water column sample collected at the UCBRD site on June 23, 2021, exceeded the chronic and acute prohibition trigger (chronic CGU = 5, acute CGU = 2). The paired *Hyalella azteca* water column test exhibited test organism survival of 0% as compared to the control and was determined to be toxic. Lambda-cyhalothrin (18 ng/L) was detected above its reporting limit and caused the exceedance of the prohibition trigger. All other pyrethroid pesticides were non-detect. A review of PUR data showed that lambda-cyhalothrin was applied to 1,583 acres of almond, 557 acres of sunflower, 538 acres of walnut, 264 acres of nursery outdoor plants, 178 acres of beans, 165 acres of tomatoes, and 48 acres of corn in the six weeks prior to the exceedance. Most of these applications were made on the ground (1,663 acres), but there were 302 acres of sunflowers to which lambda-cyhalothrin was aerially applied. During June and July 2021, non-agricultural lambda-cyhalothrin applications in Solano County were limited in the pounds of active ingredient applied and made for structural pest control (16 applications) and landscape maintenance (2 applications) purposes.

Sediment *Hyalella azteca* Toxicity

There were 28 analyses (including four field duplicates) performed to evaluate sediment toxicity to *Hyalella azteca* across 13 sites during 2021 Coalition monitoring. None of the analyses found the sampled sediment to be toxic to *Hyalella azteca*.

OTHER COALITION-MONITORED WATER QUALITY PARAMETERS

Exceedances of adopted Basin Plan objectives, CTR criteria, or ILRP Trigger Limits were observed for specific conductivity, dissolved oxygen, *E. coli*, pH, ammonia as N, and trace metals during 2021 Coalition monitoring (see **Table 16**).

Specific Conductivity

Specific conductivity was monitored in 90 samples from 20 Coalition sites. Specific conductivity exceeded the unadopted UN Agricultural Goal (700 µS/cm) in a total of 20 samples and also exceeded the California recommended 2˚ MCL (900 µS/cm) for drinking water in 11 of the 20 exceedances. Exceedances were observed at six sites.

Dissolved Oxygen

During 2021 Coalition monitoring, dissolved oxygen was measured in 90 samples at 20 Coalition sites. A total of eight samples exceeded the COLD Basin Plan limit with measured dissolved oxygen concentrations below 7.0 mg/L for waterbodies with a COLD designated beneficial use. Three samples exceeded the WARM Basin Plan limit with measured dissolved oxygen concentrations below 5.0 mg/L for waterbodies with a WARM designated beneficial use.

Dissolved oxygen exceedances are generally caused primarily by low flows, stagnant conditions, or extensive submerged aquatic vegetation in some cases. The low flows and stagnant conditions have the potential to increase diurnal variability in oxygen production by in-stream algae and macrophytes and trap organic materials that increase in-stream oxygen consumption (especially, during nighttime respiration).

E. coli Bacteria

E. coli bacteria were analyzed in 58 environmental samples, including nine field duplicates, from 19 Coalition sites. *E. coli* results exceeded the single sample maximum objective (235 MPN/100mL) in six environmental samples, including two field duplicates, from three Coalition monitoring locations.

The Basin Plan's indicator bacteria objectives are intended to protect contact recreational uses where ingestion of water is probable (e.g., swimming). Agricultural lands commonly support a large variety (and very large numbers seasonally) of birds and other wildlife. These avian and wildlife resources are known to be significant sources of *E. coli* and other bacteria in agricultural runoff and irrigation return flows. Other potential sources of *E. coli* include, but are not limited to, cattle, horses, septic systems, treated wastewater, and urban runoff.

pH

During 2021 Coalition monitoring, pH was measured in 91 samples from 20 Coalition sites. pH exceeded the Basin Plan maximum of 8.5 standard pH units (-log[H+]) in two samples.

The Basin Plan limit for pH is intended to be assessed based on "…*an appropriate averaging period that will support beneficial uses*" (CVRWQCB 2018). This parameter typically exhibits significant, natural diurnal variation over 24 hours in natural waters, with daily fluctuations controlled principally by photosynthesis, rates of respiration, and buffering capacity of the water. These processes are controlled by light and nutrient availability, concentrations of organic matter

and minerals that contribute to water hardness, and temperature. These factors combine to cause increasing pH during daylight hours and decreasing pH at night. Diurnal variations in winter are typically smaller because less light is available and there are lower temperatures and higher flows. Irrigation return flows may influence this variation primarily by increasing or decreasing in-stream temperatures or by increasing available nutrients or organic matter.

The reason for these pH exceedances was not immediately obvious nor easily determined. In most cases, the marginal pH exceedances likely were due primarily to in-stream algal and/or vascular plant respiration, caused in part by low flows or ponded and stagnant conditions and temperatures sufficient to stimulate plant and algal growth.

Trace Metals

Trace metals monitored during 2021 Coalition monitoring included the collection and analysis of both unfiltered metals (total arsenic, boron, and copper) and filtered metals (dissolved copper).

Arsenic

Eight total arsenic environmental samples, including four field duplicate samples, were collected from two Coalition sites. Two environmental samples, including one field duplicate sample, from the monitoring site at Grand Island Drain exceeded the California 1˚ MCL for total arsenic of 10 µg/L.

There are both legacy and a few current sources of arsenic in the Sacramento River Watershed. There is very little remaining agricultural use of arsenic-based pesticide products (based on a review of DPR's PUR data), and arsenic has only a few potentially significant sources: (1) natural background from arsenic in the soils, (2) arsenic remaining from legacy lead arsenate use in orchards, (3) arsenic used in various landscape maintenance and structural pest control applications (non-agriculture), and (4) arsenic used in wood preservatives. One possible source is the wooden bridge structure located just upstream of the Grand Island Drain sampling site, if arsenic-based preservatives were used on the wood. A final, but somewhat unlikely source is an arsenic-based additive that may still be used for chicken feed[10] and which can potentially make its way through the chicken and into agricultural fields and runoff if the poultry litter is used on the field.

Boron

Four total boron environmental samples, including two field duplicate samples, were collected from one Coalition site, Willow Slough Bypass at Pole Line. All four of the total boron samples, including the two field duplicate samples, exceeded the ILRP Trigger Limit for total boron of 700 µg/L, which is based on Ayers and Westcott (1985).

Boron is a naturally occurring mineral that is not applied by agriculture, but it is elevated in some irrigation supplies (especially those sourced in part or entirely from groundwater) and soils, and concentrations may be elevated through consumptive use of irrigation water. It is known to be naturally elevated in the groundwater and major tributaries supplying irrigation water in the Willow Slough drainage.

[10] http://water.usgs.gov/owq/AFO/proceedings/afo/pdf/Wershaw.pdf

Ammonia, as N

Ammonia as nitrogen (as N) was analyzed in 45 environmental samples, including nine field duplicates, at 11 Coalition sites. One ammonia as N exceedance occurred at the Willow Slough Bypass at Pole Line site, where a measured concentration of 1.2 mg/L as N exceeded the pH- and temperature-dependent 2013 USEPA NRWQC-CCC criterion of 0.8 mg/L as N.

Table 16. Other Physical, Chemical, and Microbiological Parameters Observed to Exceed Numeric Objectives in 2021 Coalition Monitoring

Site ID	Sample Date	Analyte	Unit	Result	Trigger Limit[1]	Basis for Limit[2]	Management Plan[3]
WLSPL	5/25/2021	Ammonia, Total, as N	mg/L	1.2	0.8	2013 NRWQC-CCC	Active
GIDLR	5/25/2021	Arsenic	µg/L	15	10	1˚ MCL	Active
GIDLR	5/25/2021	Arsenic[5]	µg/L	16	10	1˚ MCL	Active
WLSPL	7/22/2021	Boron	µg/L	1400	700	Narrative	Active
WLSPL	7/22/2021	Boron[5]	µg/L	1300	700	Narrative	Active
WLSPL	1/20/2021	Boron	µg/L	2900	700	Narrative	Active
WLSPL	1/20/2021	Boron[5]	µg/L	2900	700	Narrative	Active
UCBRD	9/23/2021	Dissolved Oxygen	mg/L	4.8	5	BP [SSO WARM]	Active
UCBRD	8/19/2021	Dissolved Oxygen	mg/L	4.9	5	BP [SSO WARM]	Active
COLDR	8/18/2021	Dissolved Oxygen	mg/L	4.72	7	BP [SSO COLD]	Active
PNCHY	8/19/2021	Dissolved Oxygen	mg/L	6.18	7	BP [SSO COLD]	Active
WLSPL	8/19/2021	Dissolved Oxygen	mg/L	5.34	7	BP [SSO COLD]	Active
NRTCN	7/21/2021	Dissolved Oxygen	mg/L	6.6	7	BP [SSO COLD]	Active
PNCHY	7/22/2021	Dissolved Oxygen	mg/L	5.6	7	BP [SSO COLD]	Active
WLSPL	7/22/2021	Dissolved Oxygen	mg/L	5.9	7	BP [SSO COLD]	Active
PNCHY	4/20/2021	Dissolved Oxygen	mg/L	6.5	7	BP [SSO COLD]	Active
LSNKR	4/21/2021	Dissolved Oxygen	mg/L	4.7	5	BP [SSO WARM]	Active
MDLCR	10/19/2020	Dissolved Oxygen	mg/L	4.9	7	BP [SSO COLD]	Active
UCBRD	9/23/2021	*E. coli*	MPN/100mL	2419.6	235	BP	Suspended
WLSPL	7/22/2021	*E. coli*	MPN/100mL	1046.2	235	BP	Suspended
UCBRD	4/21/2021	*E. coli*	MPN/100mL	2419.6	235	BP	Suspended
UCBRD	4/21/2021	*E. coli*[5]	MPN/100mL	2419.6	235	BP	Suspended
SSKNK	11/18/2020	*E. coli*	MPN/100mL	275.5	235	BP	Suspended

Site ID	Sample Date	Analyte	Unit	Result	Trigger Limit[1]	Basis for Limit[2]	Management Plan[3]
MDLCR	10/19/2020	*E. coli*[5]	MPN/100mL	365.4	235	BP	Suspended
PRPIT	5/26/2021	pH	-log[H+]	8.77	6.5-8.5	BP	Active
MFFGR	5/30/2021	pH	-log[H+]	9.3	6.5-8.5	BP	Active
UCBRD	9/23/2021	Specific Conductivity	µS/cm	1076[4]	700, 900	Narrative	Active
UCBRD	8/19/2021	Specific Conductivity	µS/cm	804[4]	700, 900	Narrative	Active
COLDR	8/18/2021	Specific Conductivity	µS/cm	755[4]	700, 900	Narrative	Active
WLSPL	8/19/2021	Specific Conductivity	µS/cm	1035[4]	700, 900	Narrative	Active
UCBRD	7/21/2021	Specific Conductivity	µS/cm	822[4]	700, 900	Narrative	Active
WLSPL	7/22/2021	Specific Conductivity	µS/cm	1019[4]	700, 900	Narrative	Active
UCBRD	6/23/2021	Specific Conductivity	µS/cm	771[4]	700, 900	Narrative	Active
WLSPL	6/23/2021	Specific Conductivity	µS/cm	1020[4]	700, 900	Narrative	Active
COLDR	5/25/2021	Specific Conductivity	µS/cm	1086[4]	700, 900	Narrative	Active
MFFGR	4/28/2021	Specific Conductivity	µS/cm	178[4]	700, 900	Narrative	Active
LSNKR	4/21/2021	Specific Conductivity	µS/cm	1400[4]	700, 900	Narrative	Active
UCBRD	4/21/2021	Specific Conductivity	µS/cm	711[4]	700, 900	Narrative	Active
COLDR	3/24/2021	Specific Conductivity	µS/cm	739[4]	700, 900	Narrative	Active
WLSPL	3/24/2021	Specific Conductivity	µS/cm	1362[4]	700, 900	Narrative	Active
UCBRD	2/22/2021	Specific Conductivity	µS/cm	1058[4]	700, 900	Narrative	Active
WLSPL	1/20/2021	Specific Conductivity	µS/cm	1530[4]	700, 900	Narrative	Active
FRSHC	1/19/2021	Specific Conductivity	µS/cm	976[4]	700, 900	Narrative	Active
PNCHY	1/19/2021	Specific Conductivity	µS/cm	711[4]	700, 900	Narrative	Active
COLDR	11/18/2020	Specific Conductivity	µS/cm	746[4]	700, 900	Narrative	Active
UCBRD	11/18/2020	Specific Conductivity	µS/cm	980[4]	700, 900	Narrative	Active

Notes:

1. Water Quality Objective or Narrative Interpretation Limits for ILRP.
2. Water Quality Objective Basis: BP = Central Valley Basin Plan; BPA = Basin Plan Amendment; CTR = California Toxics Rule; Narrative = unadopted limits used to interpret Basin Plan narrative objectives by the Central Valley Water Board.
3. Indicates whether sites and parameters are currently being addressed by an ongoing Management Plan, study, or TMDL.

Site ID	Sample Date	Analyte	Unit	Result	Trigger Limit[1]	Basis for Limit[2]	Management Plan[3]

4. Specific conductivity exceeded the unadopted United Nations Agricultural Goal (700 µS/cm), the California recommend 2º MCL (900 µS/cm) for drinking water, and/or the Site-Specific Objective 90th percentile limit (150 µS/cm).
5. Sample was collected as a field duplicate

Trend Analysis

As part of the evaluation of monitoring results, the WDR requires the Coalition to conduct trend analyses to…

"… identify potential trends[11] and patterns in surface and groundwater quality that may be associated with waste discharge from irrigated lands. As part of this evaluation, the third-party must analyze all readily available monitoring data that meet program quality assurance requirements to determine deficiencies in monitoring for discharges from irrigated agricultural lands and whether additional sampling locations or sampling events are needed or if additional constituents should be monitored. If deficiencies are identified, the third-party must propose a schedule for additional monitoring or source studies. … The third-party should incorporate pesticide use information, as needed, to assist in its data evaluation."

As part of the 2018 AMR, the Coalition conducted the trend analysis for all representative monitoring sites, as well as all pesticides that were detected with ≥5% detection rate[12]. From this dataset, it was determined that the sites and constituents shown in **Table 17** had potential to degrade water quality.

Table 17. Significant Trends from 2018 Trend Analysis

Category	Analyte	Site Name
Physical	Conductivity	Anderson Creek at Ash Creek Road
		Colusa Basin Drain above Knight's Landing
		Pit River at Pittville
		Sacramento Slough bridge near Karnak
		Ulatis Creek at Brown Road
		Willow Slough Bypass at Pole Line
	Dissolved Oxygen	Middle Creek u/s from Highway 20
		Coon Creek at Brewer Road
	pH	Anderson Creek at Ash Creek Road
		Colusa Basin Drain above Knight's Landing
		Lower Snake R. at Nuestro Road
		Pine Creek at Highway 32
		Willow Slough Bypass at Pole Line
	Total Organic Carbon	Walker Creek near 99W and CR33
Nutrients	Ammonia, Total as N	Cosumnes River at Twin Cities Road
		Sacramento Slough near Karnak
	Orthophosphate, as P	Ulatis Creek at Brown Road

[11] "All results (regardless of whether exceedances are observed) must be included to determine whether there are trends in degradation that may threaten applicable beneficial uses."

[12] Pesticides with lower than 5% detection rates were considered to have insufficient detected data to reliably identify trends.

Category	Analyte	Site Name
Pesticides	Simazine	Grand Island Drain
Trace Metals	Arsenic	Lower Snake River at Nuestro Road
	Boron	Willow Slough Bypass at Pole Line
Toxicity	Selenastrum growth	Anderson Creek at Ash Creek Road

Beginning in 2015, the Coalition proposed a prioritized approach that would focus on reanalyzing the higher priority trends from the most recent trend analysis. This approach was approved by the Central Valley Water Board to be implemented for the second year of an Assessment Monitoring period and for non-Assessment years. The 2021 Monitoring Year was a non-Assessment monitoring period, so the trend analysis included here followed the prioritized approach. The trend assessment for 2021 reanalyzed the following:

- High priority pesticides with historically high detection rates:
    - Chlorpyrifos
    - Diazinon
    - Diuron
- Sites with active Management Plans for *Ceriodaphnia* and *Selenastrum.*
- Nutrient data for sites that were listed in the "potential degradation subsection" of the 2018 analysis.
- Site and parameter combinations that were monitored during the 2021 Monitoring Year.

Pyrethroid pesticides were excluded from the current trend analysis due to their small dataset relative to those of other pesticides that have been monitored by the Coalition for years. Pyrethroids will be included in the Coalition's trend analysis in the *2022 Annual Monitoring Report* now that the Pyrethroid Control Program's Baseline Monitoring, required under the Pyrethroid Pesticide BPA, has been completed.

The methods used to analyze and evaluate the data for the trend analysis were as follows:

- Data were initially evaluated using Spearman's non-parametric test for trends (concentrations vs. sample date). A table of the initial Spearman's test results are provided in **Appendix G**.
    - Data below detection were coded as "0" for initial non-parametric Spearman's evaluation
    - Data were analyzed separately for each site for all parameters
    - The threshold for statistical significance was set at $p<0.05$
- Significant preliminary results ($p<0.05$) were screened for potential degradation impacts
    - Increasing trends in pesticides and nutrients
    - Decreasing trends in toxicity survival or growth results
    - The subset of the initial Spearman's test results with potential degradation impacts are provided in **Appendix G**.

- Parameters with potential degradation trend indicators were plotted (concentration vs. date) for further evaluation (plots are provided in **Appendix G**.)
    - Data below detection were plotted at the detection limit
    - Data were reviewed for potential outliers
    - Linear, log-linear, or robust trend lines were plotted to illustrate trends (the selected method was based on visual inspection and best professional judgment)
    - Plots were evaluated for other (non-trend) patterns

A determination of the significance of a potential water quality degradation trend was based on the likelihood of a continuing trend and the likelihood of adverse impacts on beneficial uses. Evaluations of beneficial use impacts were based on a continued increasing probability of exceedances of trigger limits. These determinations are provided in **Appendix G** and significant findings are discussed below.

Pesticide use data were evaluated during the process used to develop the 2021 Monitoring Plan Update, as required by the WDR, MRP, and PEP, and no additional evaluations of pesticide use data were conducted for this AMR. The results of the PEP analysis conducted in summer 2020 were incorporated into the 2021 Monitoring Plan Update that was approved by the Central Valley Water Board.

DISCUSSION OF RESULTS

The Coalition's 2021 Monitoring Plan Update was approved by Central Valley Water Board staff as meeting the requirements of the WDR, MRP, and PEP. The WDR provides no additional guidance or criteria for making a determination if there are "deficiencies in monitoring" or if additional locations or events need to be included in an annual monitoring schedule, and no deficiencies were identified as a result of the trend analysis conducted for this report.

Summary of Initial Spearman's Test Results

- Eight site-parameter combinations were evaluated.
- Four results were not significant ($p \geq 0.05$).
- Two results were not significant due to insufficient detected data.
- Two results were initially determined to have potentially significant trends ($p < 0.05$).
    - One significant result was identified for a trend with no potential negative impacts (i.e., it indicated potentially improving water quality).
    - One initially significant result was identified as suggesting potential water quality degradation with potential negative impacts on beneficial uses and was evaluated further.
- The one result (12.5% of the beginning number of evaluations) was evaluated as a trend plot and was determined to have a significant increasing trend suggesting potential water quality degradation (**Table 18**) and was evaluated further.

Table 18. Significant Trends Further Evaluated for Potential Water Quality Degradation

Category	Analyte	Site Name
Nutrients	Ammonia, Total as N	Sacramento Slough Bridge near Karnak

Total ammonia as nitrogen (N) exhibited a significant increasing trend in concentration at the Sacramento Slough monitoring site (**Figure 4-a**). The trend does not appear to indicate a continuing long-term trend in ammonia as N concentrations and there were no exceedances of the ILRP Trigger Limit for the nutrient[13]. Additional monitoring events or locations are not necessary.

The results of trend analyses conducted for this AMR did not indicate a need for the monitoring of any additional locations, events, or parameters. The Coalition recommends that the modified trend analysis no longer be performed during non-assessment years and that the full trend analysis approach be performed following the completion of the single assessment year. A three-year cycle for trend analysis would represent an increase in the frequency that the Coalition's monitoring data are statistically evaluated for the purpose of identifying potential water quality degradation.

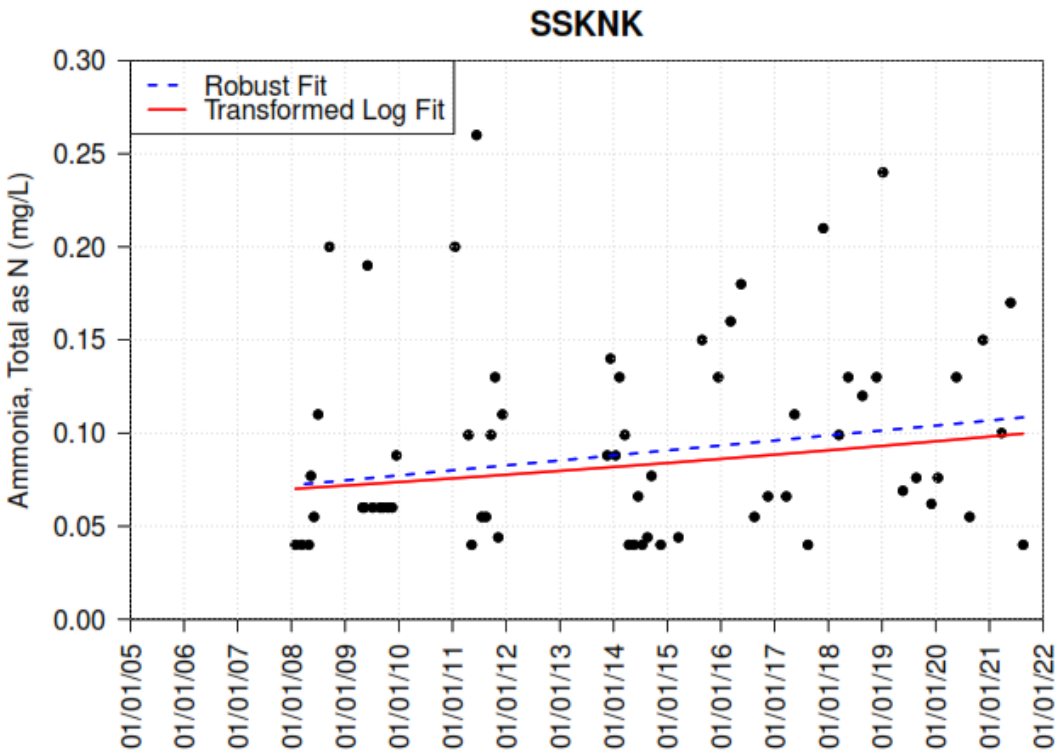

Figure 4-a. Ammonia, Total as N, Sacramento Slough Bridge near Karnak

[13] Ammonia as N concentrations measured in Coalition water quality samples are compared to criteria promulgated in the 2013 USEPA final Aquatic Life Ambient Water Quality Criteria for Ammonia – Freshwater.

Management Practices and Actions Taken

RESPONSE TO EXCEEDANCES

To address specific water quality exceedances, the Coalition and its partners initially developed a Management Plan in 2009, subsequently approved by the Central Valley Water Board. The Coalition also previously developed a *Landowner Outreach and Management Practices Implementation Communications Process for Monitoring Results (Management Practices Process)* to address exceedances. The 2009 Management Plan was reorganized into the Comprehensive Surface Water Quality Management Plan (CSQMP) in 2015. The CSQMP was last updated in September 2016 and approved by the Central Valley Water Board in November 2016. Site-specific Management Plans are included as addenda to the CSQMP as they are developed by the Coalition and approved by the Central Valley Water Board. Implementation of the CSQMP[14] is the primary mechanism for addressing exceedances observed in the Coalition's surface water monitoring.

Management Plan Status Update

The Management Plan Progress Report (MPPR), documenting the status and progress toward meeting individual Management Plan element requirements for 2021, is provided to the Central Valley Water Board with this AMR. Activities conducted in 2021 to implement the Coalition's CSQMP included addressing exceedances of objectives for registered pesticides, toxicity, nutrients, in addition to conducting monitoring required for existing toxicity and pesticide Management Plans and TMDLs.

Implementation completed specifically for registered pesticides and toxicity included review and evaluation of pesticide application data, identification of potential sources, and determination of likely agricultural sources. Prior to 2015, surveys of Coalition members operating on high priority parcels were conducted to determine the degree of implementation of relevant management practices related to individual Management Plan elements for registered pesticides and identified causes of toxicity. Beginning in 2015, these surveys were replaced with data compiled from Coalition Member Farm Evaluations, which are currently collected on a five-year cycle with the most recent survey conducted for the 2020 crop year. During the period 2017 through 2019, select Coalition Subwatersheds conducted Focused Outreach Surveys with growers who operate within the area covered by an active Management Plan for a registered pesticide and/or toxicity and who applied the registered pesticide identified in the Management Plan. The use of Focused Outreach Surveys ended when the Coalition was required to complete Management Plan Implementation Reports (MPIR) beginning with the 2020 crop year. The MPIR is used to report management practices implemented by Coalition members to comply with requirements under a Surface Water Quality Management Plan. The Coalition's Focused Outreach and MPIR survey data have been used to establish goals for additional management practice implementation needed to address exceedances of Basin Plan water quality objectives and ILRP Trigger Limits.

[14] *SVWQC Comprehensive Surface Water Quality Management Plan. Prepared for the Sacramento Valley Water Quality Coalition (SVWQC) by Larry Walker Associates, Davis, California. November 2016.*

LANDOWNER OUTREACH EFFORTS

The Coalition and its subwatersheds, working with the Coalition for Urban/Rural Environmental Stewardship (CURES), stand committed to working with the Central Valley Water Board and its staff to implement the *Management Practices Process* and the Coalition's CSQMP to address water quality problems identified in the Sacramento Valley. The primary strategic approach taken by the Coalition is to notify and educate the subwatershed landowners, farm operators, and/or wetland managers about the cause(s) of toxicity and/or exceedance(s) of water quality objectives. Notifications are focused on (but not limited to) growers who operate directly adjacent to or within close proximity to a receiving water. The broader outreach program, which includes both grower meetings and notifications distributed through direct mailings, encourages the adoption of best management practices (BMPs) and modification of the uses of specific farm and wetland inputs to prevent movement of constituents of concern into Sacramento Valley surface waters.

Targeted Outreach Efforts

The Coalition's targeted outreach approach is to focus on the growers with fields directly adjacent to or near the actual waterway of concern where statistically significant toxicity and/or exceedances of applicable numeric water quality objectives, ILRP Trigger Limits, and pyrethroid pesticide prohibition triggers have been observed at a frequency sufficient to trigger a Management Plan. To identify those landowners operating in high priority lands, the Coalition identifies the assessor parcels and subsequently, the owners of agricultural operations nearest the water bodies of interest. From the list of assessor parcel numbers, a subwatershed identifies its members and provides them an advisory notice along with information on how to address a specific exceedance using BMPs. A similar approach was also used to conduct management practice surveys in areas subject to individual Management Plan elements. However, all growers in a drainage with a Management Plan, as well as those drainages represented by a drainage with a Management Plan, are required to receive targeted outreach and submit management practices information if they apply the pesticide that is the subject of a Management Plan.

General Outreach Efforts

Outreach efforts conducted by the Coalition and its partners for specific subwatersheds during the monitoring period are summarized in an Excel table for each subwatershed in **Appendix F**. Available outreach materials are also included as attachments in **Appendix F**.

Summary of Farm Evaluation Data

Starting in 2014, the WDR required that the Coalition collect and aggregate summarized information from Farm Evaluations. In 2018, the Central Valley Water Board revised the reporting schedule, and the Coalition will now collect, aggregate, and summarize Farm Evaluations on a five-year cycle beginning with the 2020 Crop Year. The Coalition submitted the 2020 Crop Year data to the Central Valley Water Board at the end of 2021. The next Farm Evaluation will be for the 2025 Crop Year and will be submitted by November 30, 2026.

Conclusions and Recommendations

The Coalition submits this *2021 Annual Monitoring Report* as required under the Central Valley Water Board's Irrigated Lands Regulatory Program. The AMR provides a detailed description of the Coalition's monitoring results as part of its ongoing efforts to characterize water quality impacts from irrigated agricultural and wetlands operations in the Sacramento River Basin.

To summarize, the results from the Coalition's monitoring conducted during the 2021 Monitoring Year continue to indicate that with few exceptions, there are no major water quality problems as a result of discharges from agricultural lands and managed wetlands in the Sacramento River Basin.

This AMR characterizes potential water quality impacts of agricultural drainage from a broad geographic area in the Sacramento Valley from October 2020 through September 2021. To date, a total of 185 Coalition storm and irrigation season events have been completed since the beginning of Coalition monitoring in January 2005, with additional events collected by coordinating programs and for follow-up evaluations. For the period of record considered in this AMR (October 2020 through September 2021), samples were collected for nine scheduled monthly events and two wet weather ("storm") events.

Pesticides were infrequently detected (~7.0% of all pesticide results generated during the 2021 Monitoring Year were detected concentrations), and when detected, rarely exceeded applicable water quality objectives.

Many of the pesticides specifically required to be monitored in the past by the ILRP have rarely been detected in Coalition water samples. Over 98.1% of all pesticide analyses performed to date for the Coalition have been below detection. Coalition monitoring of pesticides during the 2021 Monitoring Year was conducted based on the 2016 Pesticides Evaluation Protocol (PEP) and active Management Plan element requirements. The Central Valley Water Board's PEP requires the Coalition to monitor specific registered pesticides based on (1) their rate of application in a given drainage (lb. applied per drainage) and (2) a pesticide-specific relative risk (the ratio of the amount of chemical applied to a reference value for the protection of aquatic life or human health, with a specific averaging period). The Coalition also conducted monitoring of the ILRP-required trace elements (arsenic, boron, copper, and zinc) informed by the Coalition's past monitoring results, which have demonstrated that most of these metals rarely approach or exceed objectives and are not likely to cause adverse impacts to aquatic life or human health in waters receiving agricultural runoff in the Sacramento River Watershed. This strategy for monitoring trace metals was implemented in 2010 in accordance with the Coalition's 2009 MRP (*Order No. R5-2009-0875*, CVRWQCB 2009), and this same strategy is consistent with the requirements of the current WDR and MRP (*Order No. R5-2014-0030*).

The majority of exceedances of adopted numeric objectives continue to consist of specific conductivity, dissolved oxygen, pH, and *E. coli*. Agricultural runoff and irrigation return flows may contribute to exceedances of these objectives, but these parameters are primarily controlled or significantly affected by natural processes and sources that are not controllable by agricultural management practices.

The Coalition has implemented the requirements of the ILRP since 2004. The Coalition developed a Watershed Evaluation Report (WER) that set the priorities for development and implementation of the initial Monitoring and Reporting Program Plan (MRPP). The Coalition

successfully developed the MRPP, QAPP, and Management Plan as required by the ILRP, and all were approved by the Central Valley Water Board. Subsequent revisions requested by the Central Valley Water Board and the Coalition were incorporated into the Coalition's program and implemented through the Coalition's ongoing ILRP monitoring efforts. The Coalition also continues to adapt and improve elements of its monitoring program based on the knowledge gained through its ongoing monitoring efforts.

The Coalition's 2021 monitoring program, as specified in the 2021 Monitoring Plan Update, was developed to be consistent with the requirements of the WDR and MRP (*Order No. R5-2014-0030*) and 2016 PEP, and was approved by the Central Valley Water Board for this purpose with the understanding that 2021 Monitoring Year would serve as a "non-Assessment" (i.e., "Core") monitoring period for the Coalition, but with additional pyrethroid pesticide baseline monitoring as required by the Pyrethroid Pesticide BPA. The Coalition has implemented the approved monitoring program in coordination with its subwatershed partners, has initiated follow-up activities required to address observed exceedances, and continued to implement the approved 2016 CSQMP and approved individual Management Plan elements. Throughout this process, the Coalition has kept an open line of communication with the Central Valley Water Board and has made every effort to fulfill the requirements of the ILRP in a cost-effective, scientifically defensible, and management-focused manner. This AMR is documentation of the success and continued progress of the Coalition in achieving these objectives.

References

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Appendices

The following appendices are available in electronic form on the CD provided.

Appendix A: Field Log Copies

Appendix B: Lab Reports and Chains-of-Custody

Appendix C: Tabulated Monitoring Results

Appendix D: Exceedance Reports

Appendix E: Site-Specific Drainage Maps

Appendix F: SVWQC Outreach Materials

Appendix G: Trend Analysis Results

Appendix H: Reduced Monitoring Verification Reports