MAY 2018

SACRAMENTO VALLEY
WATER QUALITY COALITION

Monitoring and Reporting Program

Annual Monitoring Report 2017

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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-R1*) (WDR).[1] The scope of the MRP and the sampling and analytical methods used in 2017 Coalition Monitoring have been approved by the Central Valley Regional Water Quality Control Board (Regional 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 constituents of concern. Additionally, the Coalition is evaluating the degree of implementation of current management practices in priority watersheds 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 that are having an impact on water quality. This iterative approach allows for the most effective use of limited human and fiscal resources.

The 2017 Coalition Monitoring was conducted in coordination with the Northeastern California Water Association (Pit River Subwatershed), the Napa County-Putah Creek Watershed Group, the Placer-Nevada-South Sutter-North Sacramento Watershed Group, the Goose Lake Watershed Group, and the Upper Feather River Watershed Group. Monitoring in the Upper Feather River and Pit River subwatersheds was conducted in coordination with California's Surface Water Ambient Monitoring Program (SWAMP) beginning in 2012.

The parameters monitored in 2017 by the Coalition to achieve these objectives are as specified in the current WDR and MRP (*Order No. R5-2014-0030-R-1*):

- 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

[1] 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).

- Nitrogen and phosphorus compounds in water

The current WDR and MRP also requires 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 Regional Water Board's Executive Officer.

Note that not all parameters are monitored at every site for every monitoring event. Specific individual parameters measured for 2017 Coalition Monitoring are listed in **Table 2**.

A total of 23 sampling sites were monitored by the Coalition and coordinating subwatershed monitoring programs during 2017 (**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 for 2017 Coalition Monitoring are summarized in **Table 4**: 2017 Coalition Monitoring Year: Planned Samples, October 2016 – September 2017

This *2017 Annual Monitoring Report* (AMR) includes results for October 2016 through September 2017.

Sample collection and analysis has been performed by the following agencies and subcontractors.

- Pacific EcoRisk (Fairfield, California) performs toxicity analyses and conducts sampling for all sites, with the specific exceptions noted below:
    - Placer County Resource Conservation District conducted sampling for the Placer-Nevada-South Sutter-North Sacramento subwatershed;
- Caltest Analytical Laboratory (Napa, California) conducted all conventional and microbiological analyses; and
- Agriculture & Priority Pollutant Laboratories, Inc. (APPL) (Clovis, California) conducted pesticide analyses.

TREND ANALYSIS

The results of trend analyses conducted for the 2015 Annual Monitoring Report did not indicate a need for any additional locations, events, or parameters. These evaluations will be conducted again for the 2018 AMR after the 2017 Assessment Monitoring period.

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 Regional 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. Implementation of the approved Management Plan is the primary mechanism for addressing exceedances observed in the Coalition's *ILRP* monitoring.

Management Plan Status Update

The Management Plan Progress Report (MPPR), documenting the status and progress toward meeting Management Plan requirements for 2017, is provided to the Regional Water Board with this Annual Monitoring Report. Activities conducted in 2017 to implement the Coalition's Management Plan included addressing exceedances of objectives for registered pesticides, development of new Management Plans, evaluation of existing Management Plans that could be deemed complete, and monitoring required for 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 Management Plans for registered pesticides and identified causes of toxicity. Beginning in 2015, these surveys were replaced with data compiled from Coalition Member Farm Evaluations. Farm Evaluation 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 *2017 Annual Monitoring Report* as required under the Regional 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 irrigated agricultural and wetlands related water quality in the Sacramento River Basin.

To summarize, the results from the *ILRP* monitoring conducted in 2017 continue to indicate that with few exceptions, there are no major water quality problems with agricultural and managed wetlands discharges 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 2016 through September 2017. To date, a total of 139 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 2016 through September 2017), samples were collected for ten scheduled monthly events and 2 wet weather ("storm") events.

Pesticides were infrequently detected (~2.1% of all pesticide results for 2017 were detected), and, when detected, rarely exceeded applicable objectives. Only one registered pesticide, dichlorvos, exceeded applicable water quality objectives or *ILRP* Trigger Limits during the current monitoring year.

Many of the pesticides specifically required to be monitored in the past by the *ILRP* have rarely been detected in Coalition water samples, including glyphosate, paraquat, and all of the pyrethroid pesticides. Over 98.5% of all pesticide analyses performed to date for the Coalition have been below detection. Coalition monitoring of pesticides for the *ILRP* for 2017 was conducted based on Management Plan requirements for the subwatersheds. The Coalition also conducted monitoring of the *ILRP*-required trace elements (arsenic and copper) 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 pesticides and 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-R1*).

The majority of exceedances of adopted numeric objectives continue to consist of specific conductivity, dissolved oxygen, 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 required elements 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 these documents were approved by the Regional Water Board. Subsequent revisions requested by the Regional 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 the monitoring program based on the knowledge gained through *ILRP* monitoring efforts.

The 2017 monitoring program was developed to be consistent with the requirements of the current WDR and MRP (*Order No. R5-2014-0030-R1*) and was approved by the Regional Water Board for this purpose with the understanding that it would serve as the second "Non-Assessment" monitoring period for the new MRP. 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 previously approved Management Plan while updating the CSQMP in 2016. Throughout this process, the Coalition has kept an open line of communication with the Regional 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 2017 also serves to document the Coalition's progress toward fulfilling 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-R1*) (WDR).[2]

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

Table 1. MRP Annual Monitoring Report Requirements[3]

MRP Section	AMR Requirement	Report Section Headings	Page
V.C.1	Signed Transmittal Letter	NA	-
V.C.2	Title page	Title page	-
V.C.3	Table of Contents	Table of Contents	*i*
V.C.4	Executive Summary	Executive Summary	*vi*
V.C.5	Description of the Coalition Group geographical area	Description of the Watershed	4
V.C.6	Monitoring objectives and design	Monitoring Objectives	5
V.C.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	7; 28
V.C.8	Location map(s) of sampling sites, crops and land uses	Appendix E: Drainage Maps	CD
V.A.1;[1] V.C.9; V.C.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

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[2] 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).

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

MRP Section	AMR Requirement	Report Section Headings	Page
V.C.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.C.12	Sampling and analytical methods used	Sampling and Analytical Methods	19
V.A.5;[1] V.A.7.c.; V.C.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.C.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	43
V.A.3-4;[1] V.C.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.C.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	44; CD
V.C.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	60
V.C.18	Evaluation of monitoring data to identify temporal and spatial trends and patterns	Trend Analysis; Appendix G: Trend Analysis Results	56
V.C.19	Summary of Nitrogen Management Plan information submitted to the Coalition	---[2]	NA

MRP Section	AMR Requirement	Report Section Headings	Page
V.C.20	Summary of Management Practice information collected as part of Farm Evaluations	Summary of Farm Evaluation Data[2]	62
V.C.21	Summary of Mitigation Monitoring	---[3]	NA
V.C.22	Summary of education and outreach activities	Management Practices and Actions Taken; Appendix F: SVWQC Outreach Materials	60
V.C.23	Reduced Monitoring/Management Plan Verification Option Reports	Appendix H: Reduced Monitoring Reports	NA
V.C.24	Conclusions and recommendations	Conclusions and Recommendations	63

1. Quarterly Submittals of Monitoring Results (WDR Provision V.A) are re-submitted with the AMR.
2. The 2016 Farm Evaluation (FE) and Nitrogen Management Plan (NMP) Summary Report will be submitted to the *ILRP* by 30 June 2017, as authorized in a letter to the Coalition dated 5 April 2017 from the Central Valley Water Board's Executive Officer.
3. This item is not applicable because no mitigation monitoring was conducted in 2016.

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 managed wetlands for waterfowl habitat; spawning grounds for numerous salmon 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 the WDR requirements, the Coalition is achieving these objectives by implementing an 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 and to inform potential users of the constituents of concern. Additionally, the Coalition is evaluating the degree of implementation of current management practices in priority watersheds 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 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 in 2017 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 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 Regional Water Board's Executive Officer.

Note that not all parameters are monitored at every site for every monitoring event. Specific individual parameters measured for 2017 Coalition Monitoring are listed in **Table 2**.

Table 2. Constituents Monitored for the 2017 Monitoring Year

Analyte	Quantitation Limit[(a)]	Reporting Unit
Physical Parameters		
Flow	NA	CFS (Ft^3/Sec)
pH	0.1 [(b)]	-log[H^+]
Specific Conductivity	0.1 [(b)]	µS/cm
Dissolved Oxygen	0.1 [(b)]	mg/L
Temperature	0.1 [(b)]	˚C
Hardness, total as $CaCO_3$	10	mg/L
Turbidity	1.0	NTU
Total Suspended Solids	3.0	mg/L
Total Organic Carbon	0.5	mg/L
Grain size (in sediment)	1	% fraction
Pathogen Indicators		
E. coli bacteria	2	MPN/100 mL
Water Column Toxicity		
Ceriodaphnia, 96-h acute	NA	% Survival
Selenastrum, 96-h short-term chronic	NA	% of Survival
Sediment Toxicity		
Hyalella, 10-day short-term chronic	NA	% Survival
Pesticides		
Benzophenyls	(c)	µg/L
Carbamates	(c)	µg/L
Herbicides	(c)	µg/L
Organochlorine	(c)	µg/L
Organophosphorus	(c)	µg/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	0.1	mg/L
Orthophosphate as P	0.1	mg/L
Phosphorus, total	0.1	mg/L

Notes:

(a) 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.

(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 Regional Water Board in June 2003, the Coalition worked directly with landowners in the 21 county watersheds to identify and develop ten (now 13) subwatershed groups. Representatives from each subwatershed group utilized agronomic and hydrologic data generated by the Coalition in an attempt to prioritize watershed areas for initial evaluation 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 priority 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 watershed 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 2017 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 for 2017 were continued from previously monitored locations and included ongoing representative sites and sites monitored only for management plans or TMDLs. A total of 14 representative sites were monitored, and Management Plan sampling was conducted at all 14 of the representative monitoring sites and at eight additional sites.

SAMPLING SITE LOCATIONS AND LAND USES

The water and sediment sites monitored by the Coalition in 2017 are listed in **Table 3**. All sites monitored in 2017 were approved by the Regional Water Board as MRP compliance sites. An overall map of Coalition and subwatershed 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 2017 Coalition Monitoring

Subwatershed	Site Name	Latitude	Longitude	Agency	Site ID & Category (Fig. 1)[1]	
Butte-Yuba-Sutter	Gilsizer Slough at George Washington Rd	39.009	-121.6716	SVWQC	GILSL	MP
Butte-Yuba-Sutter	Lower Honcut Creek at Hwy 70	39.30915	-121.59542	SVWQC	LHNCT	REP
Butte-Yuba-Sutter	Lower Snake R. at Nuestro Rd	39.18531	-121.70358	SVWQC	LSNKR	REP
Butte-Yuba-Sutter	Pine Creek at Highway 32[1]	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 KL	38.8121	-121.7741	SVWQC	COLDR	INT
Colusa Glenn	Freshwater Creek at Gibson Rd	39.17664	-122.18915	SVWQC	FRSHC	REP
Colusa Glenn	Stony Creek on Hwy 45 near Rd 24	39.71005	-122.00404	SVWQC	STYHY	MP
Colusa Glenn	Walker Creek near 99W and CR33	39.62423	-122.19652	SVWQC	WLKCH	REP
Lake	McGaugh Slough at Finley Road East	39.00417	-122.86233	SVWQC	MGSLU	MP
Lake	Middle Creek u/s from Highway 20	39.17641	-122.91271	SVWQC	MDLCR	REP
Napa	Pope Creek upstream from Lake Berryessa	38.64637	-122.36424	PCWG	PCULB	REP
Pit River	Fall River at Fall River Ranch Bridge	41.0351	-121.4864	NECWA	FRRRB	MP
Pit River	Pit River at Canby Bridge	41.4017	-120.931	NECWA	PRCAN	MP
Pit River	Pit River at Pittville	41.0454	-121.3317	NECWA	PRPIT	REP
PNSSNS	Coon Creek at Brewer Road	38.93399	-121.45184	PNSSNS	CCBRW	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	Z-Drain	38.45215	-121.6752	SVWQC	ZDDIX	MP
Upper Feather River	Middle Fk Feather River above Grizzly Cr	39.816	-120.426	UFRW	MFFGR	REP
Yolo	Willow Slough Bypass at Pole Line	38.59015	-121.73058	SVWQC	WLSPL	REP

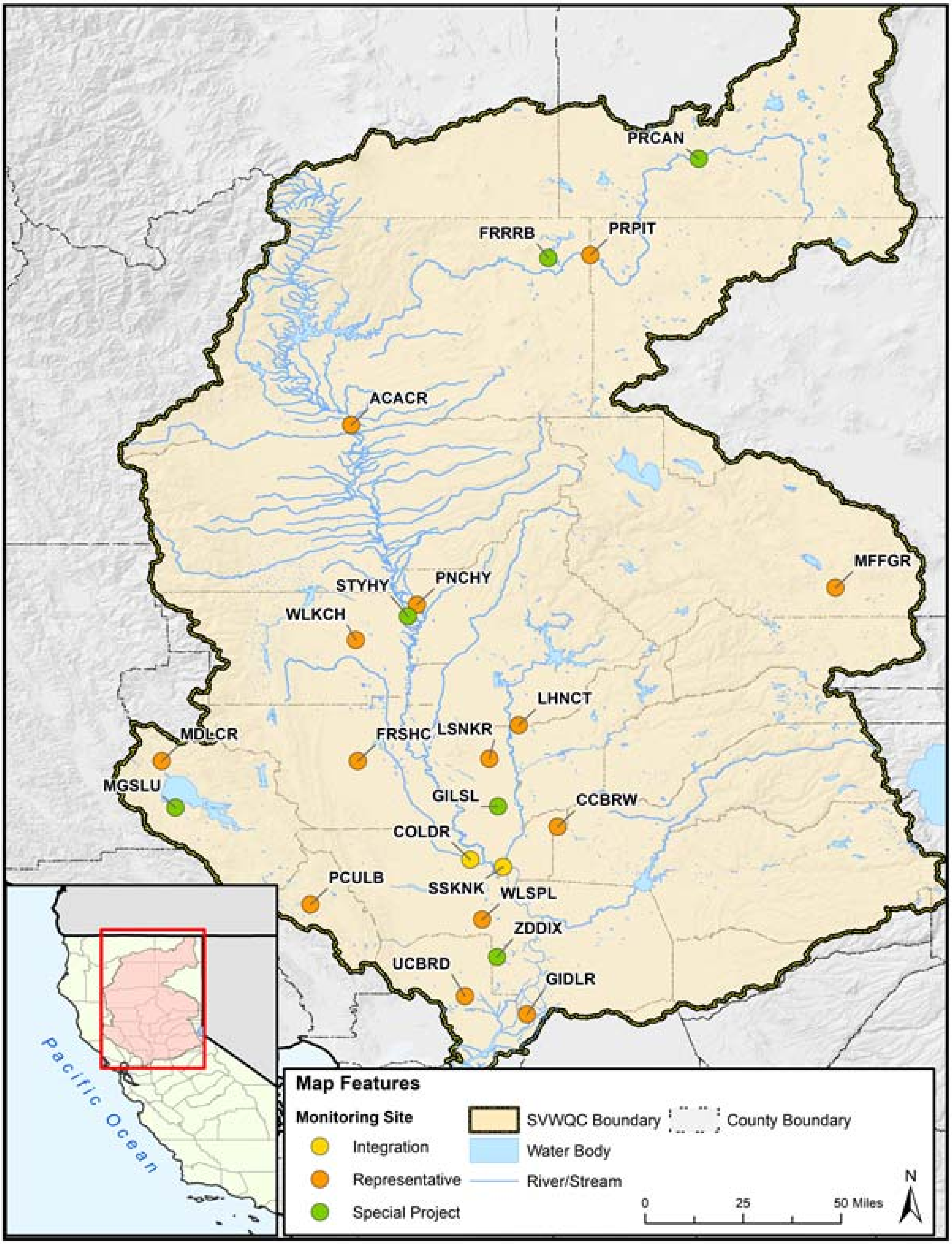

Figure 1. 2017 Coalition Monitoring Sites

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 has drained Yuba City and the area south of town. Principal crops grown in this area include prunes, walnuts, peaches, and almonds.

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 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 receives flows from North Honcut Creek and South Honcut Creek, which extend up into the foothills and include more pasture acreage.

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.

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.

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. Monitoring at this site is coordinated with the California Rice Commission.

Colusa Glenn Subwatershed

Colusa Basin Drain above Knights 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. Monitoring at this site is coordinated with the California Rice Commission.

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.

Stony Creek on Hwy 45 near Rd 24 (STYHY)

This site characterizes water from the contributing area downstream of Black Butte Reservoir just north of the town of Orland and includes approximately 20,000 acres of irrigated lands. The major irrigated crops in the Lower Stony Creek drainage are pasture, almonds, prunes, and wheat.

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 the submitted and approved *Reduced Monitoring/Management Practices Verification Option*.

Lake Subwatershed

The Lake subwatershed is currently operating under the submitted and approved *Reduced Monitoring/Management Practices Verification Option*.

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.

Napa Subwatershed

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

Pope Creek above Lake Berryessa (PCULB)

The site on Pope Creek in Napa County is downstream of major storm 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

Monitoring in this subwatershed was conducted in coordination with the Northeastern California Watershed Association (NECWA) and the California's Surface Water Ambient Monitoring Program (SWAMP).

Fall River at Fall River Ranch Bridge (FRRRB)

This site is located at the lower end of Fall River before the river is partially diverted for hydroelectric uses at the Pit 1 Power House. The majority of the Fall River flow is spring-fed water that emerges in the northern portions of the valley (e.g., Lava Creek Springs, Spring Creek Springs, Crystal Springs, Mallard Springs, Big Lake Springs, Thousand Springs, Hideaway Spring, Rainbow Spring). These springs form the Little Tule River, Tule River, Spring Creek, Lava Creek, Mallard Creek, and Ja She Creek. A major tributary to Fall River (Bear Creek) captures flow mostly from private timberland comprising approximately 27 square miles of watershed. Bear Creek joins the Fall River near Thousand Springs. Finally, small amounts of water enter the Fall River from overland flow during winter and from irrigated lands during the growing season. Pasture, wild rice, and alfalfa are the primary agriculture crops in the northern portion of the valley. Total irrigated acreage draining to this site is approximately 12,000 acres.

Pit River at Pittville Bridge (PRPIT)

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

Pit River at Canby (PRCAN)

This site captures drainage from the Alturas and Canby drainage areas, as well as drainage from the North and South Fork of Pit River and Hot Springs Valley. Land uses are primarily pasture and grain and hay crops. The irrigated acreage is approximately 50,000 acres.

Placer-Nevada-South Sutter-North Sacramento Subwatershed

Monitoring in this subwatershed was conducted in coordination with the Placer-Nevada-South Sutter-North Sacramento (PNSSNS) Subwatershed.

Coon Creek at Brewer Road (CCBRW)

This site captures drainage from the Middle Coon Creek drainage areas 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 six 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 acres (excluding rice) is approximately 13,000. This is a representative site for this subwatershed.

Sacramento/Amador 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 Delta. Approximately 8,000 irrigated acres drains 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 then flows into the Sacramento River. Crops are predominantly pasture, followed by walnuts and alfalfa/hay and then 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

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 approximately 8.5 miles south of Dixon and 1.5 miles east of State Highway 113 on Brown Road. 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 is a representative site for this subwatershed.

Z-Drain (ZDDIX)

The Z-Drain is a tributary draining into the Yolo Bypass south of Interstate 80. This site drains the SW Yolo Bypass drainage area. The major crops in this drainage include pasture, wheat, corn, tomatoes, and alfalfa. A secondary site (ZDDSS) is located immediately downstream of ZDDIX and is occasionally sampled for follow-up source evaluations.

Upper Feather River Watershed

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 therefore focused on characterizing drainage from three valleys with considerable agricultural acreage. Monitoring in this subwatershed was conducted in coordination with the Upper Feather River Watershed (UFRW) Group and the California's Surface Water Ambient Monitoring Program (SWAMP).

Middle Fork Feather River above Grizzly Creek (MFFRG)

The Middle Fork above Grizzly Creek is below the last irrigated site in the Sierra Valley subwatershed and has year-round flow in most years. This site replaced Middle Fork Feather River at County Rd A-23, which lacks year-round flows (often dry by mid-July) and has numerous non-agricultural uses, including recreation and filling water trucks. 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 and water bodies in the Central Valley. This objective will be 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 will be 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) and approved by the Regional Water Board.

Surface water samples were collected for analysis of the constituents listed in **Table 2** as specified in the Coalition's Monitoring Plans. 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; any deviations from these methods were explained.

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 sample contamination. Samples were cross-sectional composite samples or mid-stream, mid-depth grab samples, depending on sampling site and event characteristics. When grab sample collection methods were used, samples were taken at approximately mid-stream and mid-depth at the location of greatest flow (where feasible). Where appropriate, water samples were collected using a standard multi-vertical depth integrating method. Abbreviated sampling methods (i.e., weighted-bottle or dip sample) may be used for collecting representative water samples.

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 wadeable 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 and number of samples for 2017 Coalition Monitoring are summarized in **Table 4**. The Coalition's monitoring strategy for 2017 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 *R5-2014-0030*-R1 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-R1*.

Table 4: 2017 Coalition Monitoring Year: Planned Samples, October 2016 – September 2017

SiteID	Water Column Sample Events	Sediment Sample Events	pH, conductivity, DO, temperature, flow	Turbidity, TSS, TOC	Pathogen Indicators: *E.coli*	Nutrients Group	Nutrients: Total P	Arsenic (total)	Boron (total)	Copper (total and dissolved)	Hardness	Chlorothalonil	Chlorpyrifos	Diazinon	Diuron	Hexazinone	Malathion	Methomyl	Naled (dichlorvos)	Oxyfluorfen	Metolachlor	Algae - Selenastrum	Water Flea - Ceriodaphnia	Hyalella azteca[1]
ButteYubaSutter																								
SSKNK	4		4	4	4	4				1	1	4			2		1		1	4	1	4	4	2
LHNCT	4		4		3					3	3													
PNCHY	6		6		4					4	4		6											
GILSL	4		4										3	1										
LSNKR	7	1	7		3			4															3	1
ColusaGlenn																								
FRSHC	3		3		3																			
COLDR	4	2	4	4	4	4				1	1	3			2	2	3	4		4	3	4	4	2
STYHY	2		2																				2	
WLKCH	4		4		3																			
Lake																								
MGSLU	4		4				4																	
MDLCR	4		4		3		4																	
Napa																								
PCULB	1		1																					1

SiteID	Water Column Sample Events	Sediment Sample Events	pH, conductivity, DO, temperature, flow	Turbidity, TSS, TOC	Pathogen Indicators: *E.coli*	Nutrients Group	Nutrients: Total P	Arsenic (total)	Boron (total)	Copper (total and dissolved)	Hardness	Chlorothalonil	Chlorpyrifos	Diazinon	Diuron	Hexazinone	Malathion	Methomyl	Naled (dichlorvos)	Oxyfluorfen	Metolachlor	Algae - Selenastrum	Water Flea - Ceriodaphnia	Hyalella azteca[1]
NECWA																								
FRRRB	4		4																					
PRCAN	4		4																					
PRPIT	4		4		4	4																		
PNSSNS																								
CCBRW	4		4																					
SacramentoAmador																								
GIDLR	4		4		3	2		3																
ShastaTehama																								
ACACR	3		3		3																			
Solano																								
UCBRD	2		2			2																		
ZDDIX	2	2	2																					2
UpperFeatherRiver																								
MFFGR	4		4																					
Yolo																								
WLSPL	5		5		3				3					2	1		2						1	
Totals	***83***	***5***	***83***	***8***	***40***	***16***	***8***	***7***	***3***	***9***	***9***	***7***	***9***	***3***	***5***	***2***	***6***	***4***	***1***	***8***	***4***	***8***	***14***	***8***

Note:
(1) Sediment grain size is analyzed along with sediment toxicity. 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 for filtered and unfiltered fractions of the samples. 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 generate acceptable precision and recoveries, and other analytical and quality control parameters documented in the Coalition's QAPP. Analytical methods used for chemical analyses follow accepted standard methods or approved modifications of these methods, and all procedures for analyses are documented in the QAPP or are available for review and approval at each laboratory.

Toxicity Testing and Toxicity Identification Evaluations

Water quality samples were analyzed for toxicity to *Ceriodaphnia dubia* and *Selenastrum capricornutum* for 2017 Monitoring. 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* (USEPA 2002a). Toxicity tests with *Ceriodaphnia* were conducted as 96-hour static renewal tests, with renewal 48 hours after test initiation.
- Determination of 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* (USEPA 2002b). Toxicity tests with *Selenastrum* were conducted as a 96-hour static non-renewal test.

For all initial screening toxicity 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 toxicity test, a multiple dilution test using a minimum of five sample dilutions was conducted with the initial water sample to estimate the magnitude of toxicity.

Procedures in the Coalition's QAPP state that if any measurement endpoint from any of the two aquatic 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, 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.

Detection and Quantitation Limits

The Method Detection Limit (MDL) is the minimum analyte concentration that can be measured and reported with a 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 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 some cases.

Project Quantitation Limits

Laboratories generally establish QLs that are reported with the analytical results—these may be called *reporting limits*, *detection limits*, *reporting detection limits*, or several other terms used by different laboratories. In most cases, these laboratory limits are less than or equal to the project QLs listed in **Table 5** and **Table 6**. Wherever possible, project QLs are lower than the proposed or existing relevant numeric water quality objectives or toxicity thresholds, as required by the *ILRP*.

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

Table 5. Laboratory Method Detection Limit (MDL) and Quantitation Limit (QL) Data Quality Objectives for Analyses of Surface Water

Method	Analyte	Fraction	Units	MDL	QL	Note
Physical and Conventional Parameters						
EPA 130.2	Hardness, total as $CaCO_3$	Unfiltered	mg/L	3	5	
EPA 180.1; SM2130B	Turbidity	Unfiltered	NTU	0.1	1.0	
SM20-2540 C	Total Dissolved Solids (TDS)	Particulate	mg/L	4	10	(a)
EPA 160.2; SM2540D	Total Suspended Solids (TSS)	Particulate	mg/L	2	3	
EPA 415.1; SM5310C	Organic Carbon, Total (TOC)	Unfiltered	mg/L	0.1	0.5	
Pathogen Indicators						
SM 9223	*E. Coli* bacteria	NA	MPN/100mL	2	2	
Organophosphorus Pesticides						
EPA 625(m)	Azinphos methyl	Unfiltered	µg/L	0.05	0.1	
EPA 625(m)	Chlorpyrifos	Unfiltered	µg/L	0.005	0.01	
EPA 625(m)	Demeton-S	Unfiltered	µg/L	0.005	0.01	
EPA 625(m)	Diazinon	Unfiltered	µg/L	0.005	0.01	
EPA 625(m)	Dichlorvos	Unfiltered	µg/L	0.005	0.01	
EPA 625(m)	Dimethoate	Unfiltered	µg/L	0.005	0.01	
EPA 625(m)	Disulfoton	Unfiltered	µg/L	0.01	0.02	
EPA 625(m)	Ethoprop	Unfiltered	µg/L	0.001	0.002	(a)
EPA 625(m)	Fenchlorphos	Unfiltered	µg/L	0.002	0.004	(a)
EPA 625(m)	Fensulfothion	Unfiltered	µg/L	0.001	0.002	(a)
EPA 625(m)	Fenthion	Unfiltered	µg/L	0.002	0.004	(a)
EPA 625(m)	Malathion	Unfiltered	µg/L	0.005	0.01	
EPA 625(m)	Methamidophos	Unfiltered	µg/L	0.05	0.01	
EPA 625(m)	Methidathion	Unfiltered	µg/L	0.01	0.02	
EPA 625(m)	Mevinphos	Unfiltered	µg/L	0.008	0.0016	(a)
EPA 625(m)	Naled	Unfiltered	µg/L	0.2	0.5	(a)
EPA 625(m)	Parathion, Methyl	Unfiltered	µg/L	0.01	0.02	
EPA 625(m)	Parathion, Ethyl	Unfiltered	µg/L	0.01	0.02	
EPA 625(m)	Phorate	Unfiltered	µg/L	0.01	0.02	
EPA 625(m)	Phosmet	Unfiltered	µg/L	0.05	0.1	
EPA 625(m)	Sulprofos	Unfiltered	µg/L	0.001	0.002	(a)
EPA 625(m)	Tetrachlorvinphos	Unfiltered	µg/L	0.002	0.004	(a)
EPA 625(m)	Tokuthion	Unfiltered	µg/L	0.003	0.006	(a)
EPA 625(m)	Trichloronate	Unfiltered	µg/L	0.001	0.002	(a)
Organochlorine Pesticides						
EPA 625(m)	4,4'-DDT (o,p' and p,p')	Unfiltered	µg/L	0.001	0.005	
EPA 625(m)	4,4'-DDE (o,p' and p,p')	Unfiltered	µg/L	0.001	0.005	
EPA 625(m)	4,4'-DDD (o,p' and p,p')	Unfiltered	µg/L	0.001	0.005	
EPA 625(m)	Aldrin	Unfiltered	µg/L	0.001	0.005	
EPA 625(m)	Chlordane	Unfiltered	µg/L	0.001	0.005	
EPA 8081A	Chlorothalonil	Unfiltered	µg/L	0.1	0.2	(a)
EPA 625(m)	Dacthal	Unfiltered	µg/L	0.008	0.05	

Method	Analyte	Fraction	Units	MDL	QL	Note
EPA 625(m)	Dicofol	Unfiltered	µg/L	0.05	0.1	
EPA 625(m)	Dieldrin	Unfiltered	µg/L	0.001	0.005	
EPA 625(m)	Endosulfan I	Unfiltered	µg/L	0.001	0.005	
EPA 625(m)	Endosulfan II	Unfiltered	µg/L	0.001	0.005	
EPA 625(m)	Endosulfan sulfate	Unfiltered	µg/L	0.001	0.005	
EPA 625(m)	Endrin	Unfiltered	µg/L	0.001	0.005	
EPA 625(m)	Endrin Aldehyde	Unfiltered	µg/L	0.001	0.005	
EPA 625(m)	Endrin Ketone	Unfiltered	µg/L	0.001	0.005	
EPA 625(m)	HCH	Unfiltered	µg/L	0.001	0.005	
EPA 625(m)	Heptachlor	Unfiltered	µg/L	0.001	0.005	
EPA 625(m)	Heptachlor epoxide	Unfiltered	µg/L	0.001	0.005	
EPA 625(m)	Hexachlorobenzene	Unfiltered	µg/L	0.001	0.005	
EPA 625(m)	Methoxychlor	Unfiltered	µg/L	0.001	0.005	
EPA 625(m)	Mirex	Unfiltered	µg/L	0.001	0.005	
EPA 625(m)	Nonachlor	Unfiltered	µg/L	0.001	0.005	
EPA 625(m)	Oxychlordane	Unfiltered	µg/L	0.001	0.005	
EPA 625(m)	Perthane	Unfiltered	µg/L	0.001	0.005	
Carbamate and Urea Pesticides						
EPA 8321	Aldicarb	Unfiltered	µg/L	0.2	0.4	
EPA 8321	Aminocarb	Unfiltered	µg/L	0.2	0.4	
EPA 8321	Barban	Unfiltered	µg/L	1.75	3.5	
EPA 8321	Benomyl/Carbendazim	Unfiltered	µg/L	0.2	0.4	
EPA 8321	Carbaryl	Unfiltered	µg/L	0.05	0.07	
EPA 8321	Carbofuran	Unfiltered	µg/L	0.05	0.07	
EPA 8321	Chlorpropham	Unfiltered	µg/L	0.4	0.8	
EPA 8321	Methiocarb	Unfiltered	µg/L	0.2	0.4	
EPA 8321	Methomyl	Unfiltered	µg/L	0.05	0.07	
EPA 8321	Mexacarbate	Unfiltered	µg/L	0.4	0.8	
EPA 8321	Oxamyl	Unfiltered	µg/L	0.2	0.4	
EPA 8321	Propham	Unfiltered	µg/L	1.75	3.5	
EPA 8321	Propoxur	Unfiltered	µg/L	0.2	0.4	
Pyrethroid Pesticides						
GCMS-NCI	Allethrin	Unfiltered	µg/L	0.0001	0.0015	
GCMS-NCI	Bifenthrin	Unfiltered	µg/L	0.0001	0.0015	
GCMS-NCI	Cyfluthrin	Unfiltered	µg/L	0.0002	0.0015	
GCMS-NCI	Cypermethrin	Unfiltered	µg/L	0.0002	0.0015	
GCMS-NCI	Deltamethrin/Tralomethrin	Unfiltered	µg/L	0.0002	0.003	
GCMS-NCI	Esfenvalerate/Fenvalerate	Unfiltered	µg/L	0.0002	0.003	
GCMS-NCI	Fenpropathrin	Unfiltered	µg/L	0.0002	0.0015	
GCMS-NCI	Fluvalinate	Unfiltered	µg/L	0.0002	0.0015	
GCMS-NCI	Lambda-Cyhalothrin	Unfiltered	µg/L	0.0002	0.0015	
GCMS-NCI	Permethrin	Unfiltered	µg/L	0.002	0.015	
GCMS-NCI	Tetramethrin	Unfiltered	µg/L	0.0002	0.0015	

Method	Analyte	Fraction	Units	MDL	QL	Note
Other Herbicides						
EPA 8321	Bromacil	Unfiltered	µg/L	0.2	0.4	(a)
EPA 8321	Chloroxuron	Unfiltered	µg/L	0.2	0.4	
EPA 8081A	Dacthal	Unfiltered	µg/L	0.008	0.05	
EPA 8321	Diuron	Unfiltered	µg/L	0.2	0.4	
EPA 8321	Fenuron	Unfiltered	µg/L	0.2	0.4	
EPA 8321	Fluometuron	Unfiltered	µg/L	0.2	0.4	
EPA 8141A	Hexazinone	Unfiltered	µg/L	0.1	0.5	(a)
EPA 8321	Linuron	Unfiltered	µg/L	0.2	0.4	
EPA 625	Merphos	Unfiltered	µg/L	0.001	0.002	(a)
EPA 625	Metolachlor	Unfiltered	µg/L	0.26	0.5	(a)
EPA 8321	Monuron	Unfiltered	µg/L	0.2	0.4	
EPA 8321	Neburon	Unfiltered	µg/L	0.2	0.4	
EPA 8321	Oryzalin	Unfiltered	µg/L	0.2	0.4	
EPA 8081A	Oxyfluorfen	Unfiltered	µg/L	0.008	0.05	
EPA 8321	Propachlor	Unfiltered	µg/L	0.2	0.4	(a)
EPA 8321	Siduron	Unfiltered	µg/L	0.2	0.4	
EPA 625(m)	Simazine	Unfiltered	µg/L	0.005	0.01	
EPA 8321	Tebuthiuron	Unfiltered	µg/L	0.2	0.4	
Benzophenyls						
EPA 8321	Diflubenzuron	Unfiltered	µg/L	0.2	0.4	
Trace Elements						
EPA 200.8	Arsenic	Filtered, Unfiltered	µg/L	0.08	0.5	
EPA 2008	Cadmium	Filtered, Unfiltered	µg/L	0.04	0.1	
EPA 200.8	Boron	Filtered, Unfiltered	µg/L	0.04	0.1	
EPA 200.8	Copper	Filtered, Unfiltered	µg/L	0.2	0.5	
EPA 200.8	Lead	Filtered, Unfiltered	µg/L	0.02	0.25	
EPA 200.8	Selenium	Unfiltered	µg/L	0.5	1	
Nutrients						
EPA 350.1; 350.2	Ammonia, Total as N	Unfiltered	mg/L	0.02	0.1	
EPA 353.2	Nitrate + Nitrite as N	Unfiltered	mg/L	0.02	0.05	
EPA 365.2; SM4500-P E	Orthophosphate, as P	Unfiltered	mg/L	0.01	0.05	
EPA 365.2; SM4500-P E	Phosphorus, Total	Unfiltered	mg/L	0.02	0.05	
EPA 351.3; 351.2	Total Kjeldahl Nitrogen	Unfiltered	mg/L	0.07	0.1	

Note:
(a) No QL target has been established for this analyte.

Table 6. Laboratory Method Detection Limit (MDL) and Quantitation Limit (QL) Data Quality Objectives for Analyses of Sediments for the Coalition Monitoring and Reporting Program Plan

Method	Analyte	Fraction	Units	MDL	QL
Physical and Conventional Parameters					
SM 2560D	Grain Size Analysis	NA	% fraction	NA	1
EPA 160.3	Solids (TS)	Total	%	NA	0.1
EPA 9060	Organic Carbon, Total (TOC)	Total	mg/kg d.w.	50	200
Pyrethroids					
EPA 8270C(m)	Allethrin	Total	ng/g d.w.	0.1	1
EPA 8270C(m)	Bifenthrin	Total	ng/g d.w.	0.1	1
EPA 8270C(m)	Cyfluthrin	Total	ng/g d.w.	0.1	1
EPA 8270C(m)	Cypermethrin	Total	ng/g d.w.	0.1	1
EPA 8270C(m)	Deltamethrin/Tralomethrin	Total	ng/g d.w.	0.15	1
EPA 8270C(m)	Esfenvalerate/Fenvalerate	Total	ng/g d.w.	0.15	1
EPA 8270C(m)	Fenpropathrin	Total	ng/g d.w.	0.15	1
EPA 8270C(m)	Fluvalinate	Total	ng/g d.w.	0.1	1
EPA 8270C(m)	Lambda-Cyhalothrin	Total	ng/g d.w.	0.1	1
EPA 8270C(m)	Permethrin	Total	ng/g d.w.	0.1	1
EPA 8270C(m)	Tetramethrin	Total	ng/g d.w.	0.1	1
Organochlorine Pesticides					
EPA 8270C(m)	Chlorpyrifos	Total	ng/g d.w.	0.1	3
EPA 8270C(m)	Diazinon	Total	ng/g d.w.	5	40

Monitoring Results

The following sections summarize the monitoring conducted by the Coalition and its Subwatershed partners in 2017 (October 2016 through September 2017).

SUMMARY OF SAMPLE EVENTS CONDUCTED

This report presents monitoring results from 12 Coalition sampling events (Events 128-139), as well as data for events conducted by coordinating Subwatershed monitoring programs and other agencies between October 2016 and September 2017. Samples collected for all of these events are listed in **Table 7**.

The Delta Regional Monitoring Program (DRMP) conducted sampling for the Coalition at UCBRD (Ulatis Creek at Brown Road) from October 2016 to June 2017. The DRMP is responsible for validating and submitting these results to CEDEN.

The Department of Water Resources conducted monitoring at FRRRB, PRPIT, and PRCAN in November of 2016 and February, May, and August of 2017 and MFFGR in November of 2016 and August of 2017.

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 at four sites as part of the assessment and source evaluation efforts for the Management Plan requirement for sediment toxicity. 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 2016 through September 2017 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**, 85 of the 91 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 93%. Planned sample collection at two Coalition locations did not occur because the monitoring sites were dry or inaccessible. Planned sampling that was not completed successfully is summarized below:

- Samples for one event planned for Lower Honcut Creek (LHNCT) were not collected because the sampling site was flooded.
- Samples for one event planned for Ulatis Creek at Brown Road (UCBRD) were not collected because the sampling site was flooded. Samples were collected during the following month.
- Samples for one event at Fall River Bridge (FRRRB), Pit River at Canby (PRCAN), and Pit River at Pitville (PRPIT) and two events for the Middle Fork of the Feather River (MFFGR) were not collected due to heavy storm conditions and a shift of resources to managing the Oroville Dam.

Table 7. Sampling for the 2017 Coalition Monitoring Year

		Sample Count		128	129	130	131	132	133	134	135	136	137	138	139
Subwatershed (Agency)	**Site ID**	**Planned**	**Collected**	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**
Butte-Yuba-Sutter (SVWQC)	GILSL	3	3	-	-	-	-	W	-	-	-	-	W	W	-
	LHNCT	4	3	W	-	-	-	NS[1]	-	W	W	-	-	-	-
	LSNKR	7	7	-	W	W	W	W	W	-	-	-	W	W	-
	PNCHY	8	8	W	-	W	-	-	-	W	W	W	W	W	W
	SSKNK	4	4	-	W	-	-	-	W,S	-	W	-	-	W,S	-
Colusa Glenn (SVWQC)	COLDR	4	4	-	W	-	-	-	W,S	-	W	-	-	W,S	-
	FRSHC	3	3	-	-	W	-	-	-	W	-	-	-	W	-
	STYHY	2	2	-	-	-	W	-	W	-	-	-	-	-	-
	WLKCH	4	4	-	-	-	-	-	W	-	-	-	W	W	W
Lake (SVWQC)	MDLCR	4	4	-	W	-	-	W	-	-	W	-	-	W	-
	MGSLU	4	3	-	D	-	-	W	-	W	-	-	W	-	-
Napa (SVWQC)	PCULB	1	1	-	-	-	-	-	S	-	-	-	-	-	-
Pit River (NECWA)	FRRRB	4	3	-	DWR	-	-	NS[1]	-	-	DWR	-	-	DWR	-
	PRCAN	4	3	-	DWR	-	-	NS[1]	-	-	DWR	-	-	DWR	-
	PRPIT	4	3	-	DWR	-	-	NS[1]	-	-	DWR	-	-	DWR	-
PNSSNS	CCBRW	4	4	-	-	-	-	-	-	W	W	-	W	-	W
Sac/Amador (SVWQC)	GIDLR	4	4	-	-	-	W	W	-	W	-	-	-	-	W
Shasta/Tehama (SVWQC)	ACACR	2	2	-	-	-	-	-	-	-	W	-	W	-	-
Solano (SVWQC)	UCBRD	11	11	RMP	W,RMP	RMP	NS[1],RMP	W,RMP	RMP	RMP	RMP	RMP	W	W	-
	ZDDIX	1	1	-	-	-	-	-	-	S	-	-	-	-	-
Yolo (SVWQC)	WLSPL	5	5	-	-	W	W	-	W	W	-	-	-	W	-
Upper Feather River (UFRW)	MFFGR	4	2	-	DWR	-	-	NS[1]	-	-	NS[1]	-	-	DWR	-
	Totals	**91**	**85**												

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

DWR = Monitoring Completed by the Department of Water Resources
RMP = Monitoring completed by the Delta Regional Monitoring Program
[1] = Samples not collected due to flooding

SUMMARY OF SAMPLING CONDITIONS

Samples were collected throughout the year for the Coalition (see **Table 2**, Sampling for the 2017 Coalition Monitoring Year). The October 1, 2016 through September 30, 2017, monitoring year was characterized by above-average precipitation during the months of October, December, January, February, and April, and below-average precipitation during all other months.[4] The water year was classified as "Wet" for the Sacramento Valley by the California Department of Water Resources, with an estimated 213% of average total runoff (based on 1966-2015 mean).[5,6] The mean temperature was warmer than the historical average (1949-2005), with an increase of 1.9 degrees Fahrenheit (ºF). At the end of the 2017 water year, statewide precipitation was 165% of average and reservoir storage was 120% of average.[7]

The two sample collection periods include the wet season monitoring period from November 2016 to March 2017, and the irrigation season from April 2017 through September 2017. October 2016 is classified as irrigation season, but is attributed to the previous year's period. The wet season monitoring period had below-average precipitation in November and March with above-average amounts in the remaining months. The irrigation season had above-average precipitation in April and below-average in all other months.

Regional precipitation patterns for October 2016 through September 2017 are illustrated in **Figure 2-a** through **Figure 2-f**. Compared to previous water years, more frequent precipitation events of varying sizes occurred throughout the year from October to June, resulting in relatively high flows (**Figure 3-a** through **Figure 3-f**). Water samples were collected during high- and low-flow hydrologic conditions.

Based on climate data available from the Sacramento Executive Airport weather station, rainfall during the April – September 2017 irrigation season was greater than average during April and less than average from May through September (**Table 17**). No precipitation (or only trace amounts) occurred from July through September. Aside from a below normal November and March, precipitation was above normal in October, from December through February, and in April. The maximum temperature exceeded 90° on 7 days in May, 16 days in June, 28 days in July, 20 days in August, and 13 days in September.

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[4] Climate data (general trends) for the Sacramento-Delta region available at: http://www.wrcc.dri.edu/monitor/cal-mon/frames_version.html

[5] http://cdec.water.ca.gov/cgi-progs/iodir/WSIHIST and http://cdec.water.ca.gov/cgi-progs/previous/WSI

[6] Sacramento River Region unimpaired runoff, for water year 2017, was about 38.0 million acre-feet (MAF), approximately 213% of average. During water year 2016, the observed Sacramento River Region unimpaired runoff was about 17.4 MAF, or 98% of average.

[7] http://www.water.ca.gov/floodmgmt/hafoo/hb/csm/docs/Monthly_Weather_Summary_092016.pdf

Table 8. Summary of Climate Data[8] at Sacramento Executive Airport, October 2016 – September 2017

Month	Departure from Normal Mean Temperature	Days with Maximum Temperature ≥ 90°F	Precipitation Total (Inches)	Departure from Normal Precipitation
October 2016	-1.1	0	4.72	3.77
November 2016	1.5	0	1.12	-0.96
December 2016	-0.8	0	3.61	0.36
January 2017	0.5	0	9.92	6.28
February 2017	1.4	0	8.25	4.78
March 2017	2.0	0	2.38	-0.37
April 2017	0.1	0	2.93	1.78
May 2017	1.9	7	0.05	-0.63
June 2017	3.1	16	0.10	-0.11
July 2017	3.2	28	Trace	0.00
August 2017	2.4	20	0.00	-0.05
September 2017	2.1	13	Trace	-0.29

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

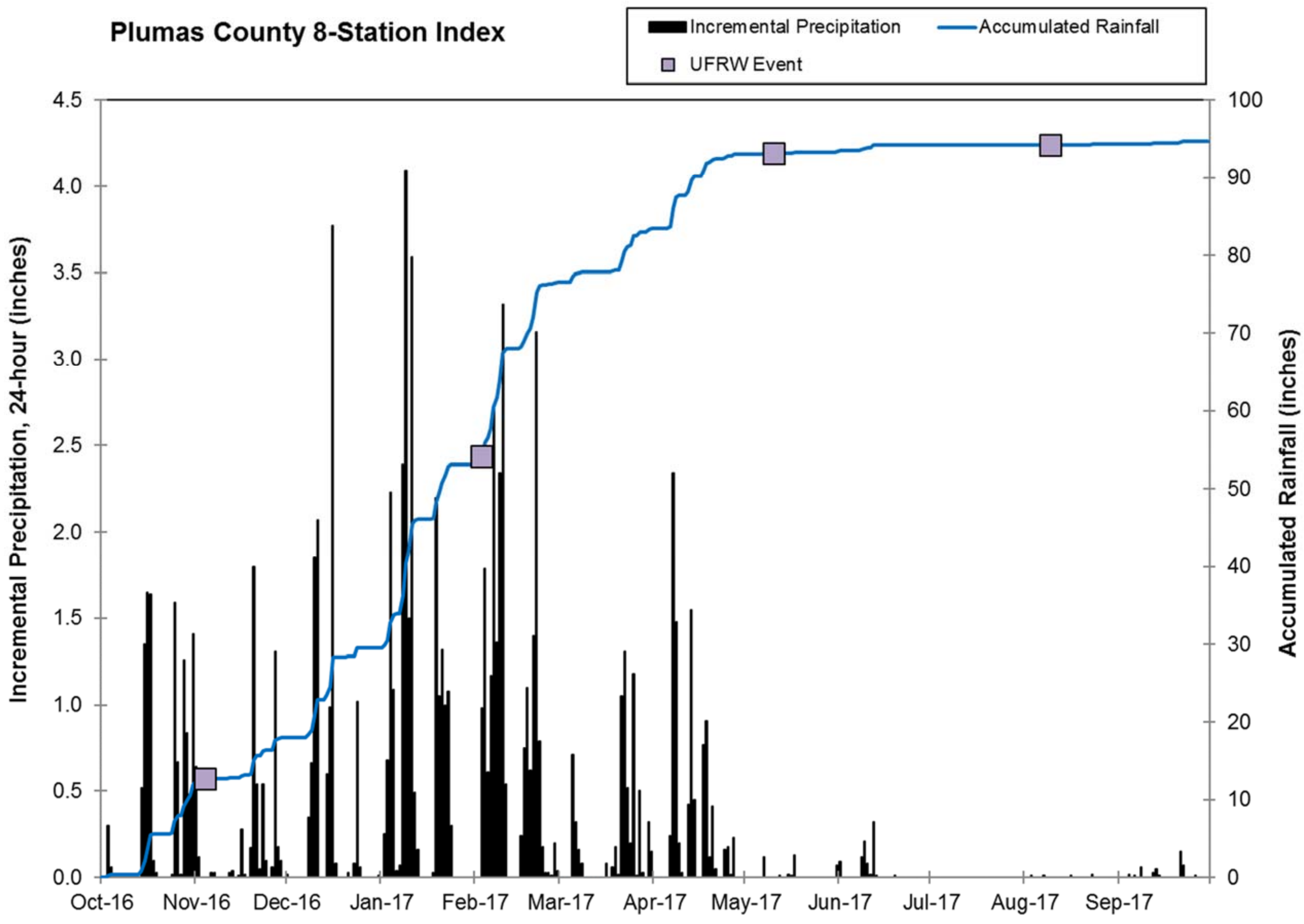

Figure 2-a. Precipitation during 2017 Coalition Monitoring: Plumas County

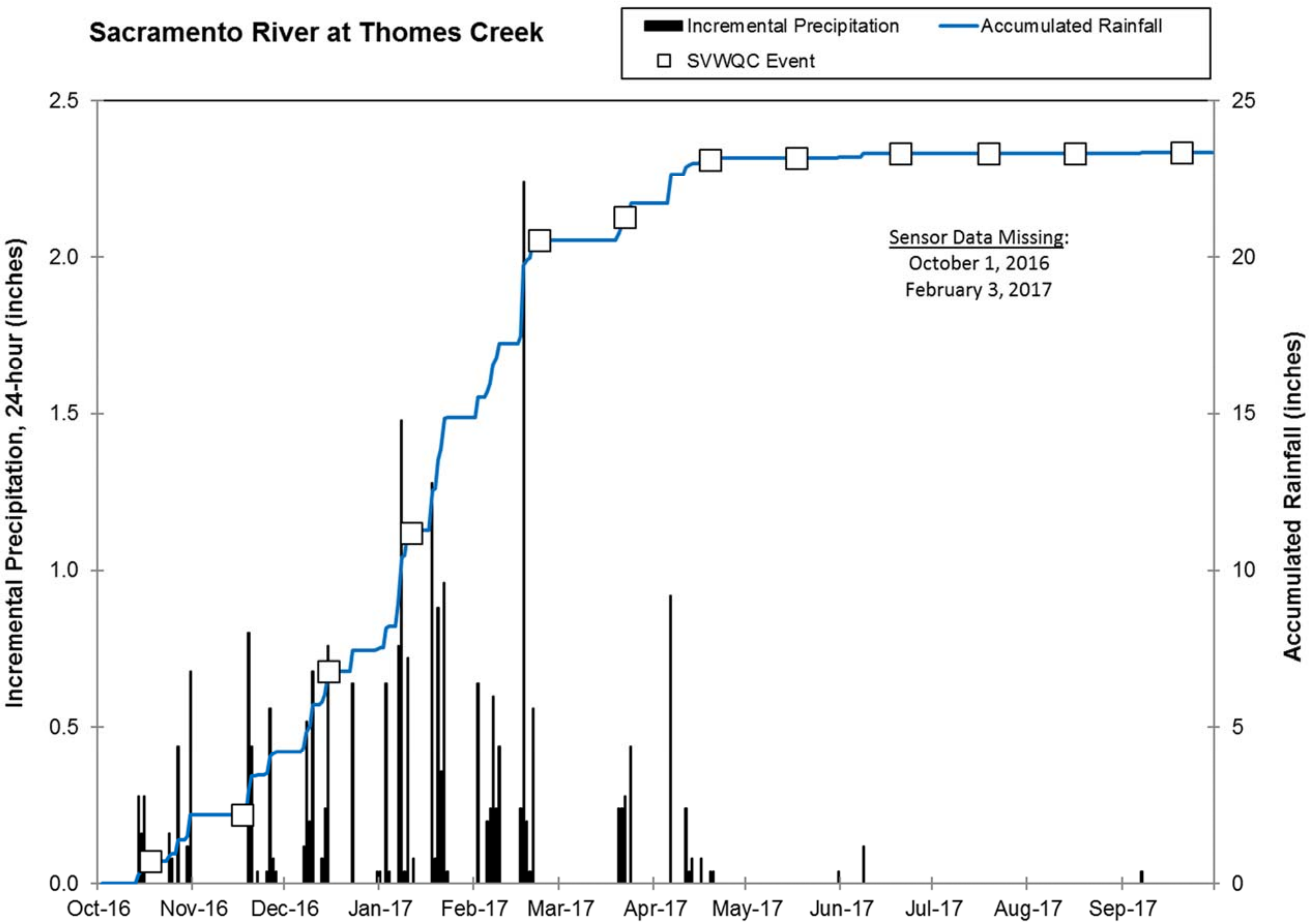

Figure 2-b. Precipitation during 2017 Coalition Monitoring: Upper Sacramento Valley

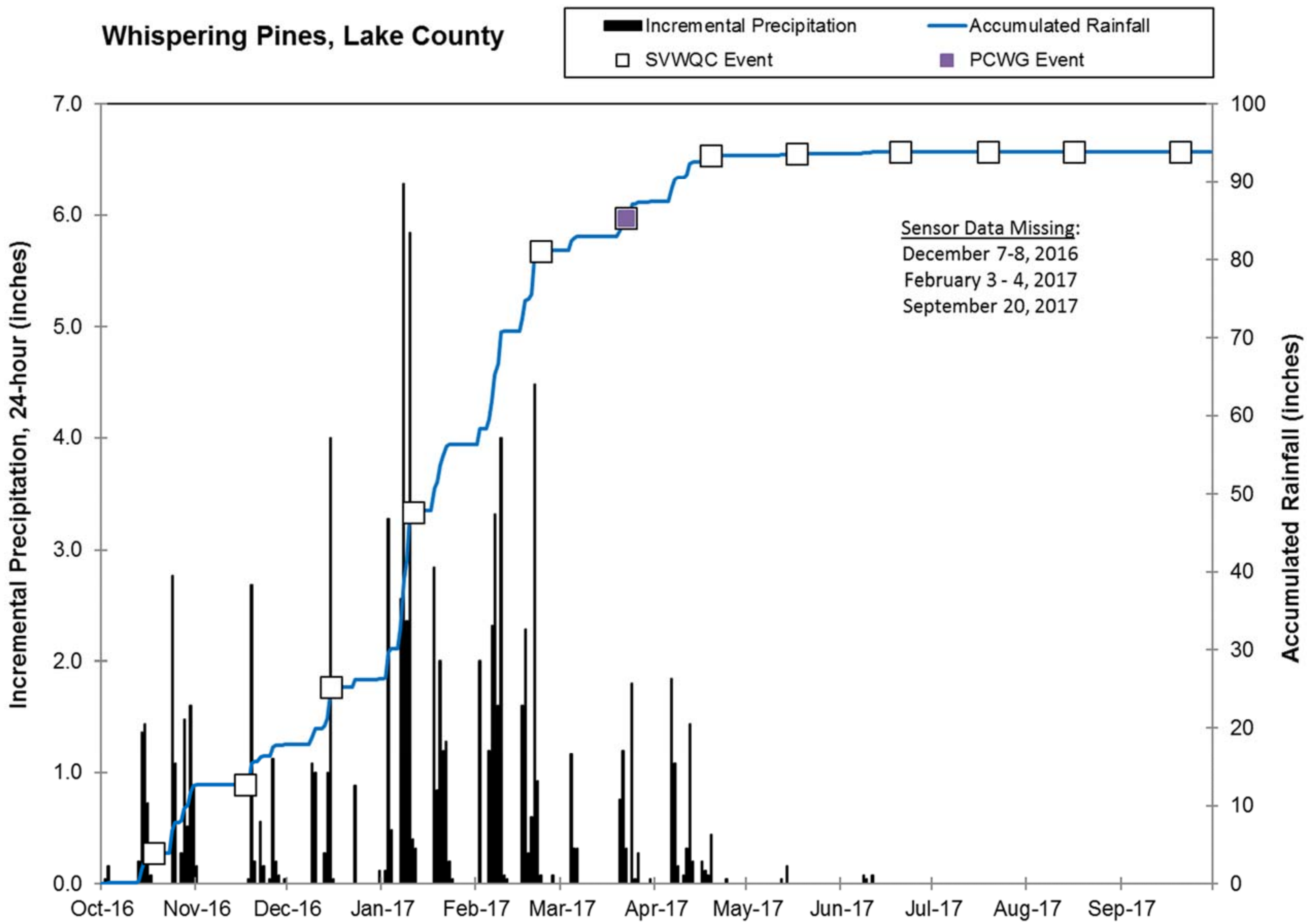

Figure 2-c. Precipitation during 2017 Coalition Monitoring: Lake County

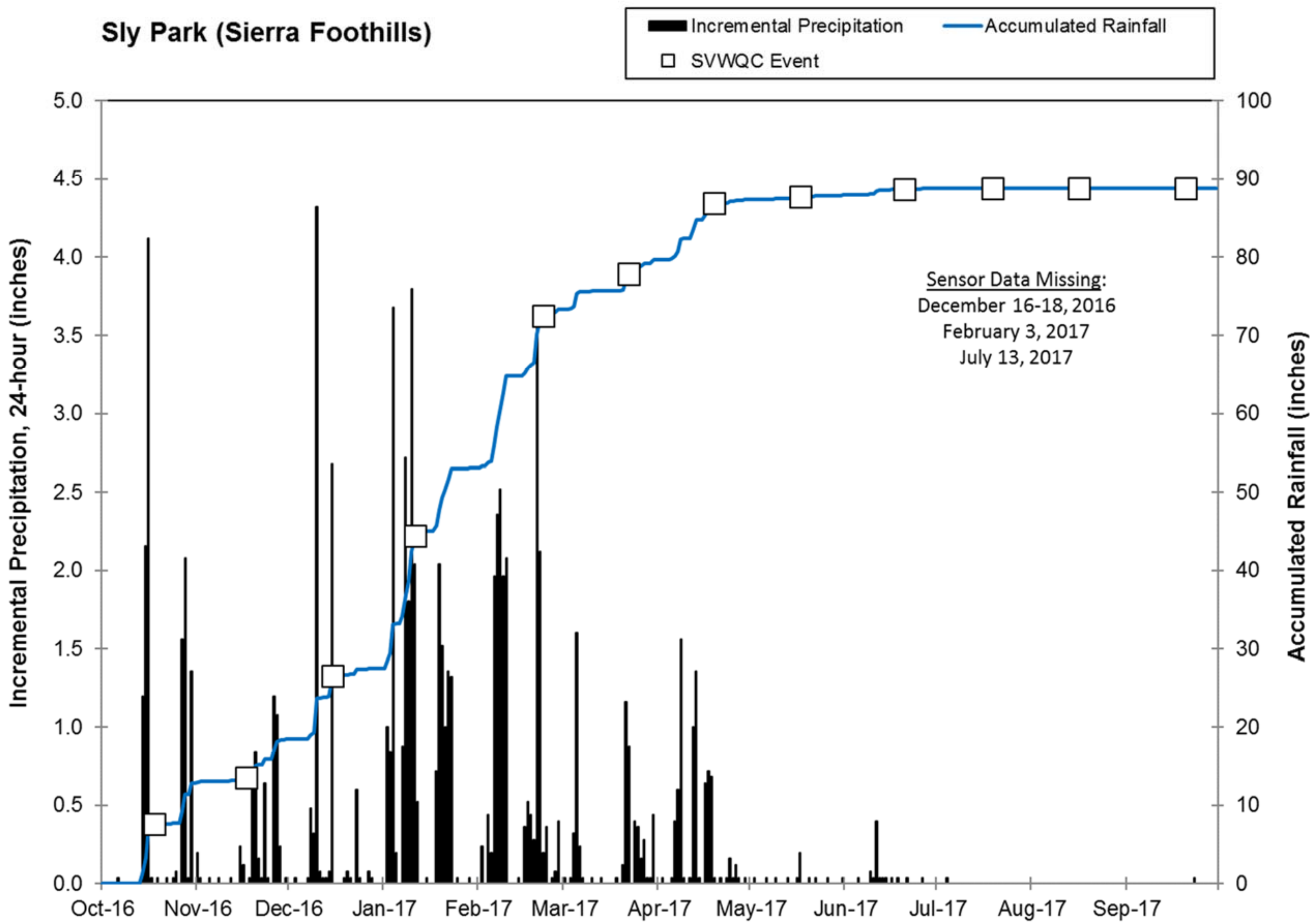

Figure 2-d. Precipitation during 2017 Coalition Monitoring: Sierra Foothills

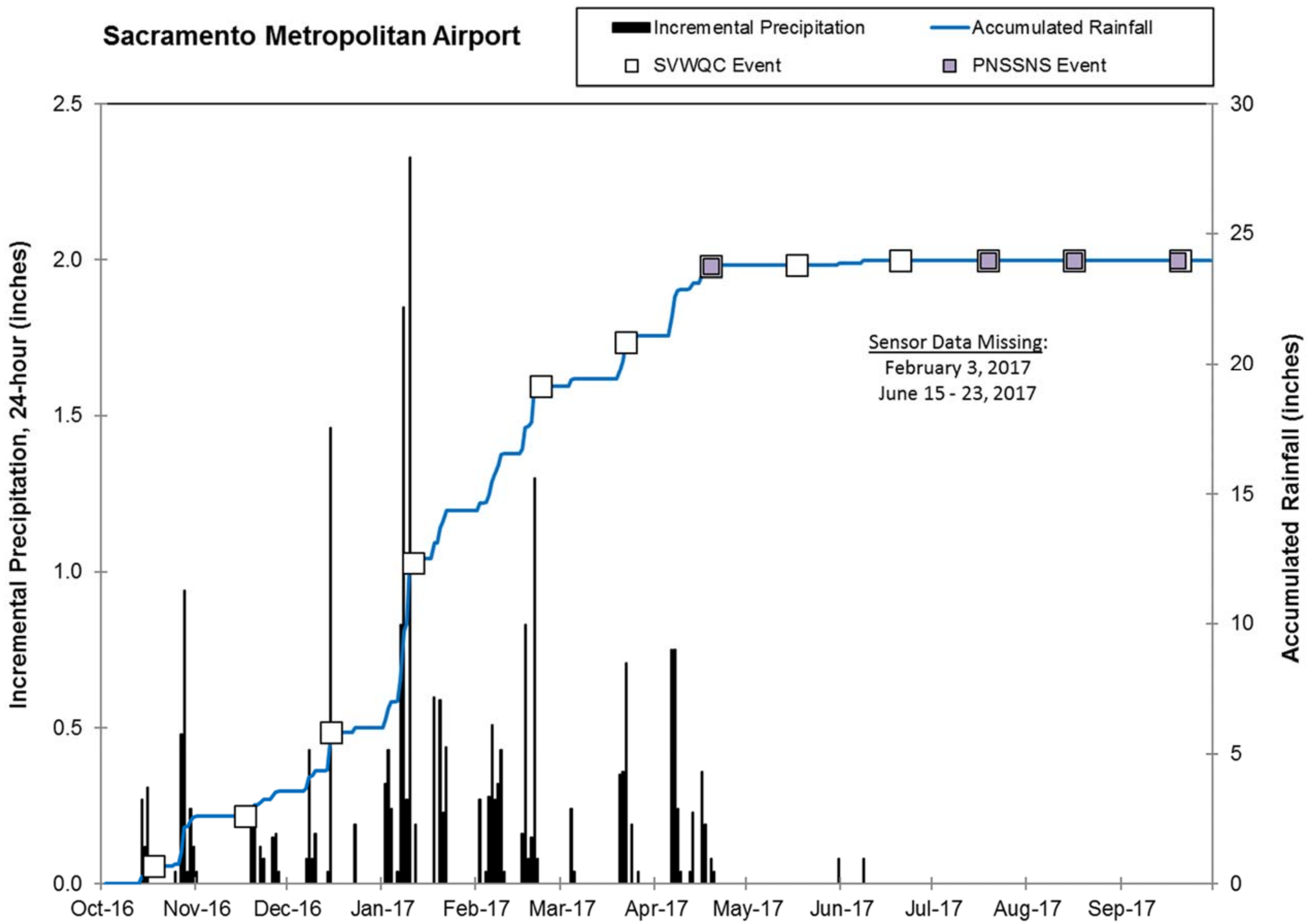

Figure 2-e. Precipitation during 2017 Coalition Monitoring: Lower Sacramento Valley

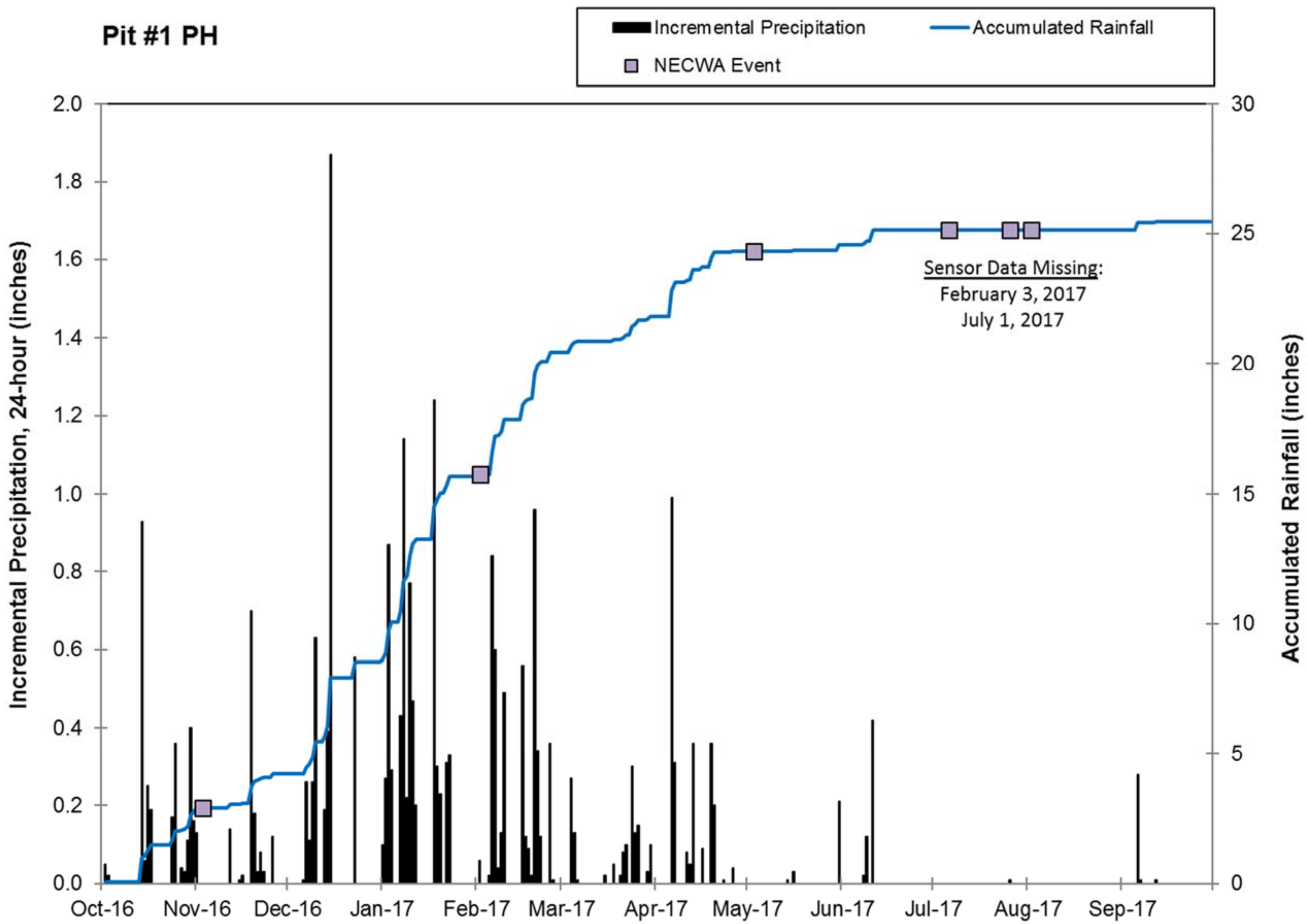

Figure 2-f. Precipitation during 2017 Coalition Monitoring: Pit River

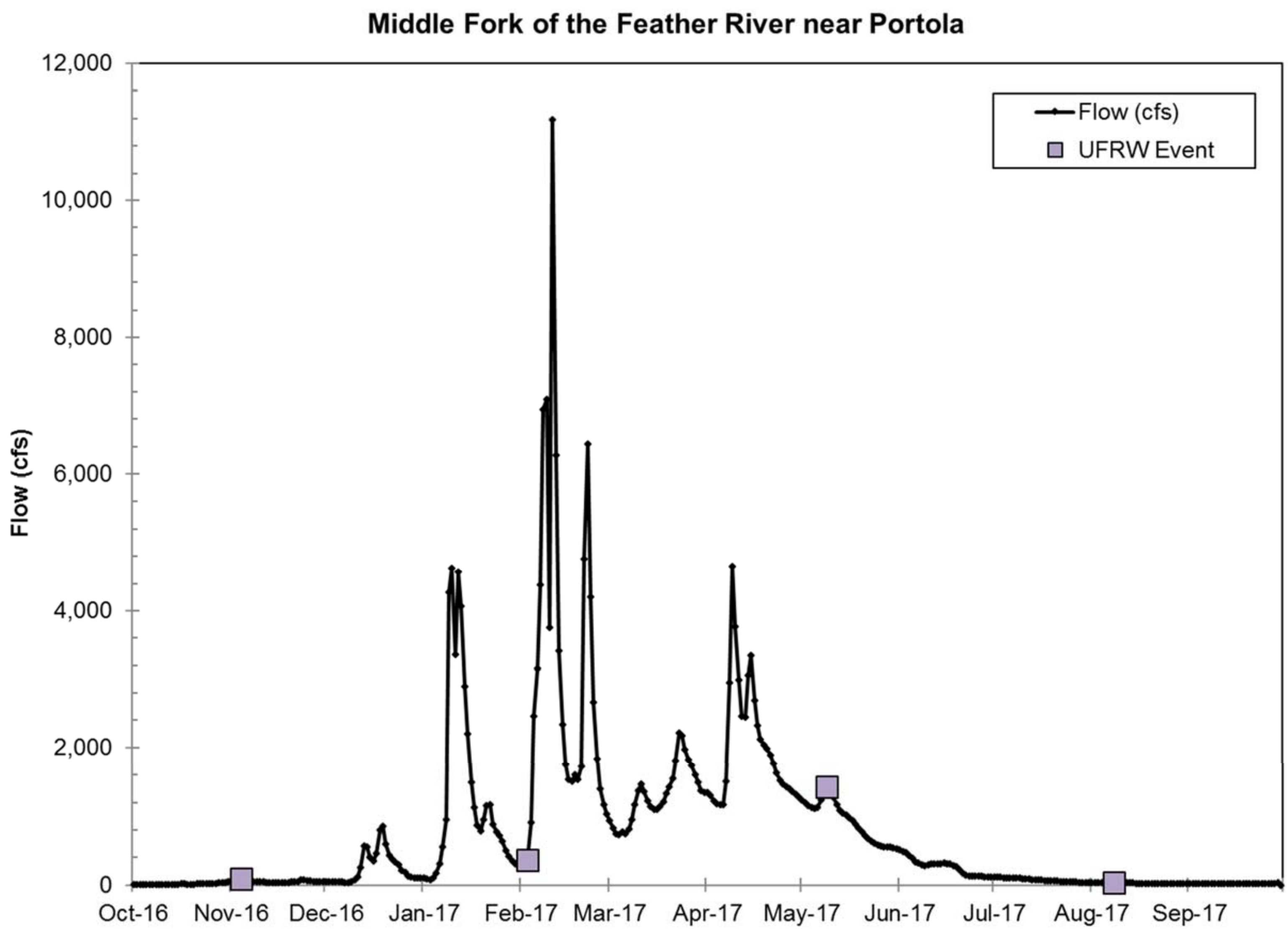

Figure 3-a. Flows during 2017 Coalition Monitoring: Plumas County

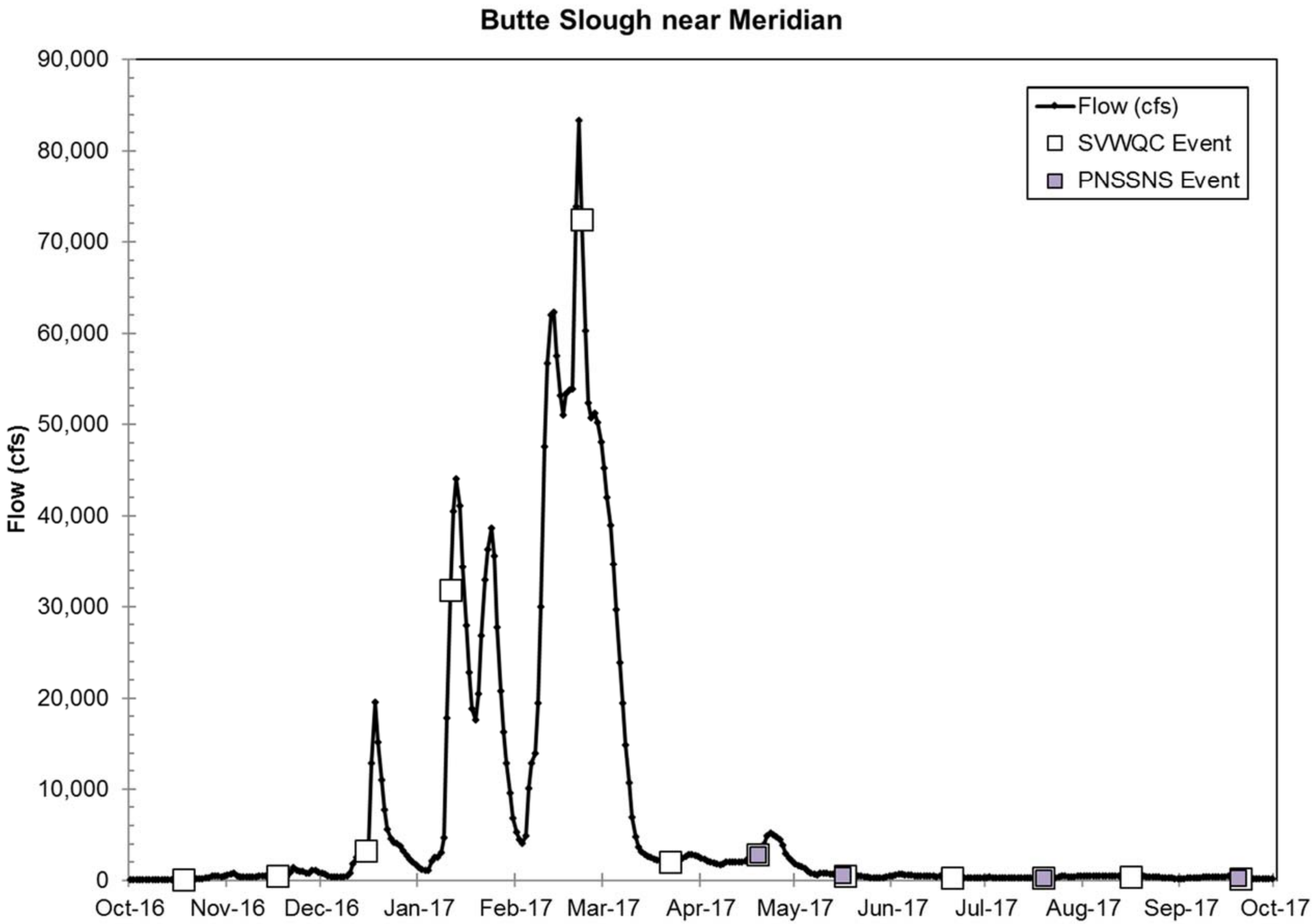

Figure 3-b. Flows during 2017 Coalition Monitoring: East Sacramento Valley

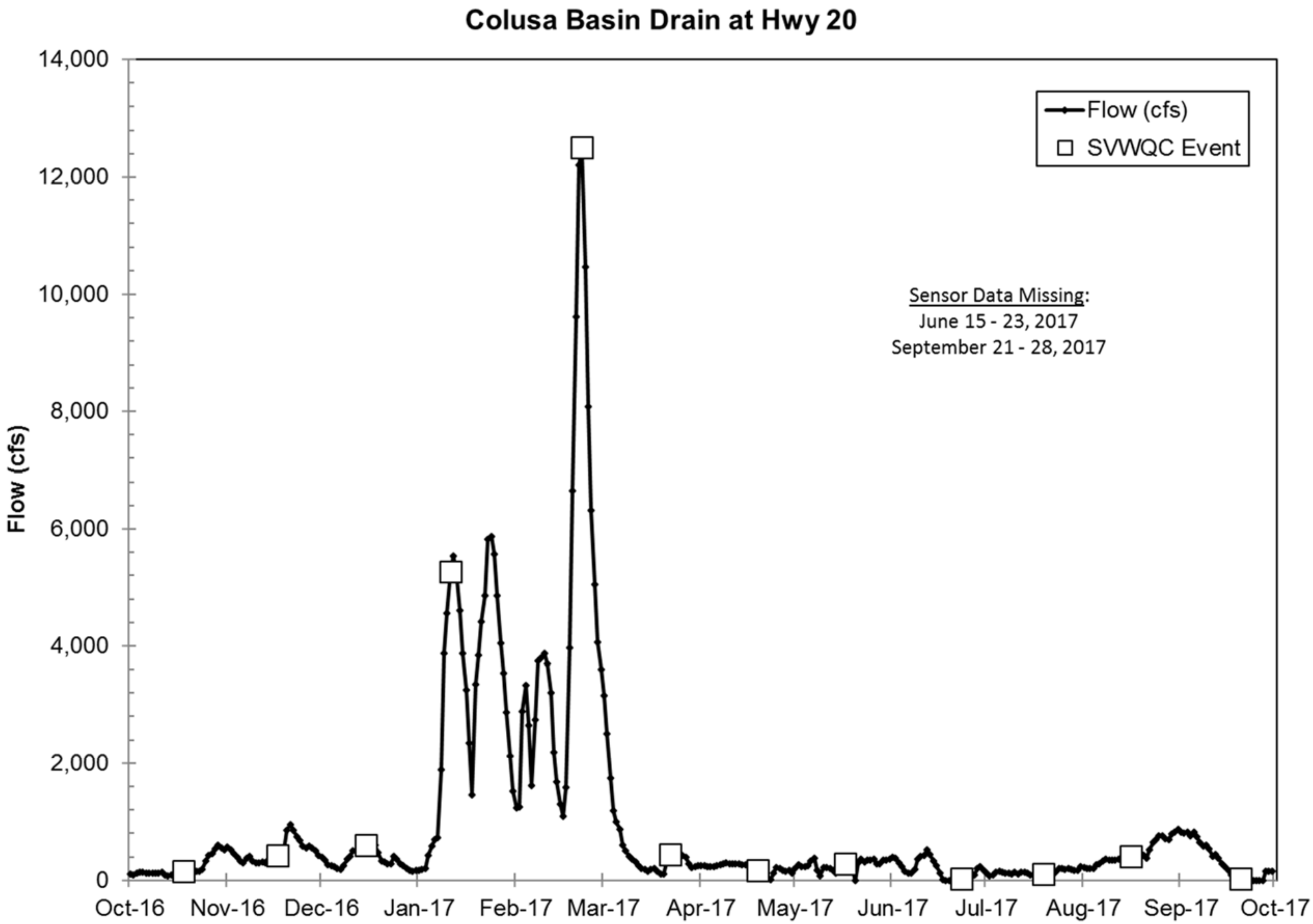

Figure 3-c. Flows during 2017 Coalition Monitoring: West Sacramento Valley

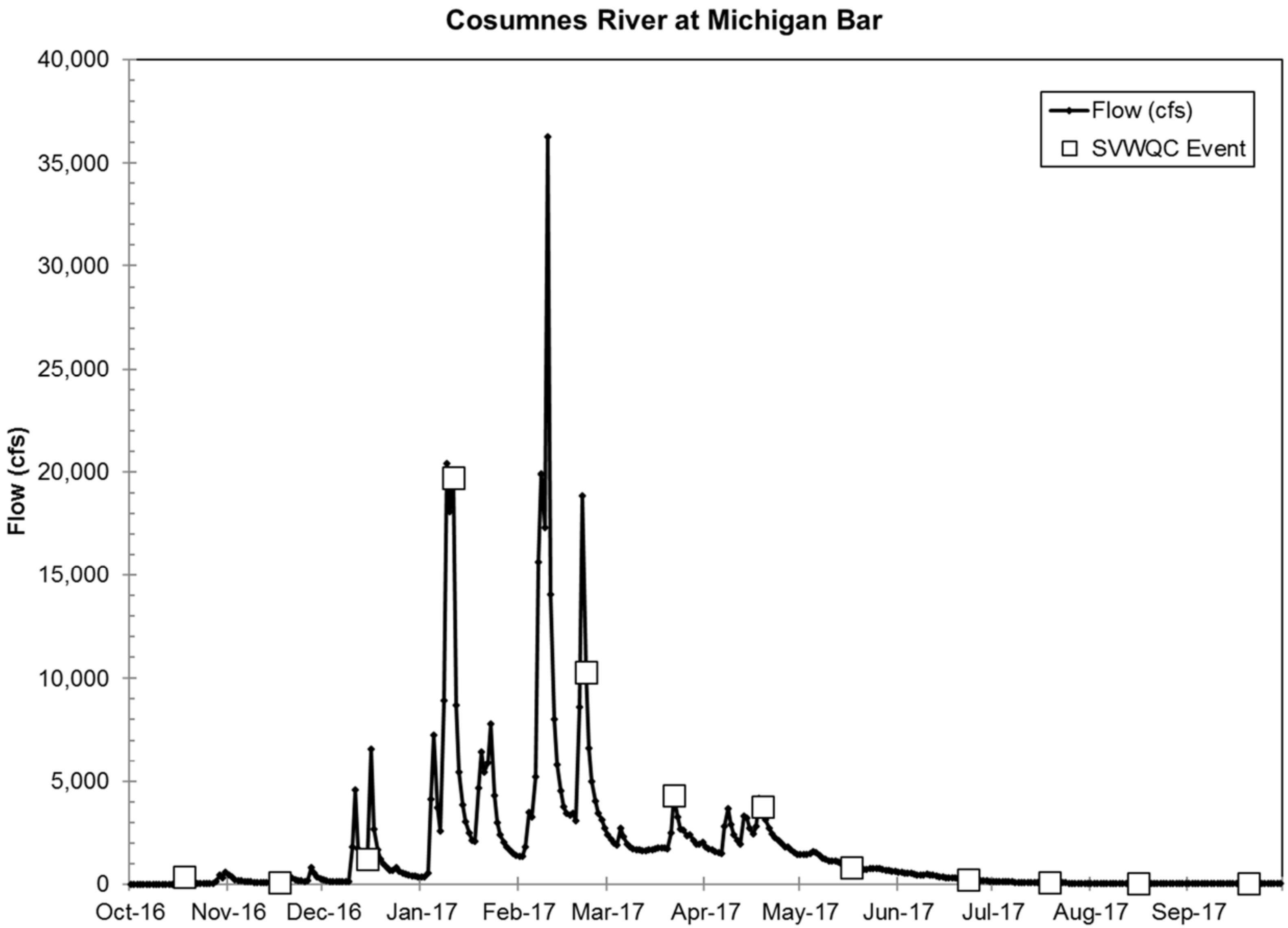

Figure 3-d. Flows during 2017 Coalition Monitoring: Lower Sacramento Valley

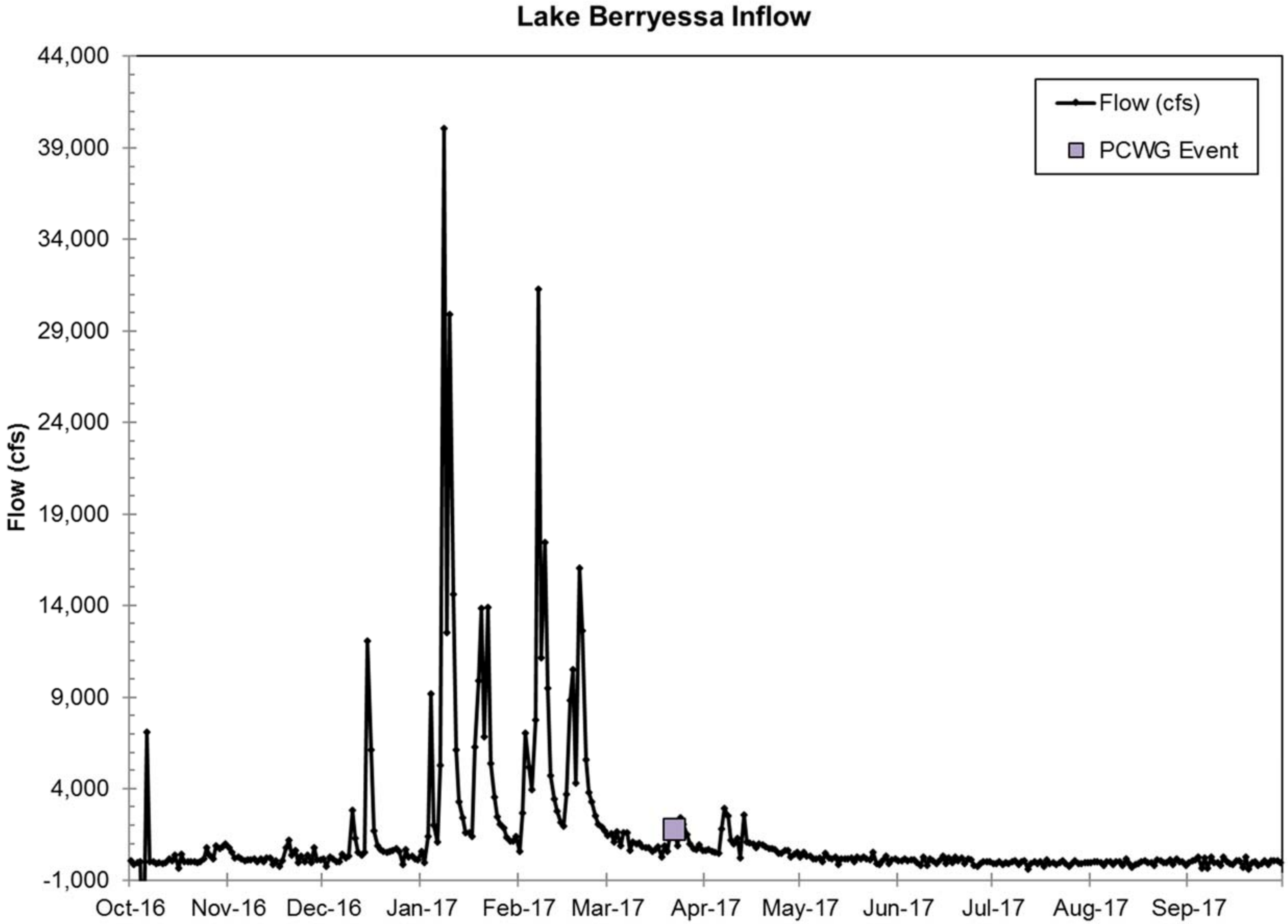

Figure 3-e. Flows during 2017 Coalition Monitoring: Lake Berryessa (Reservoir Inflow)

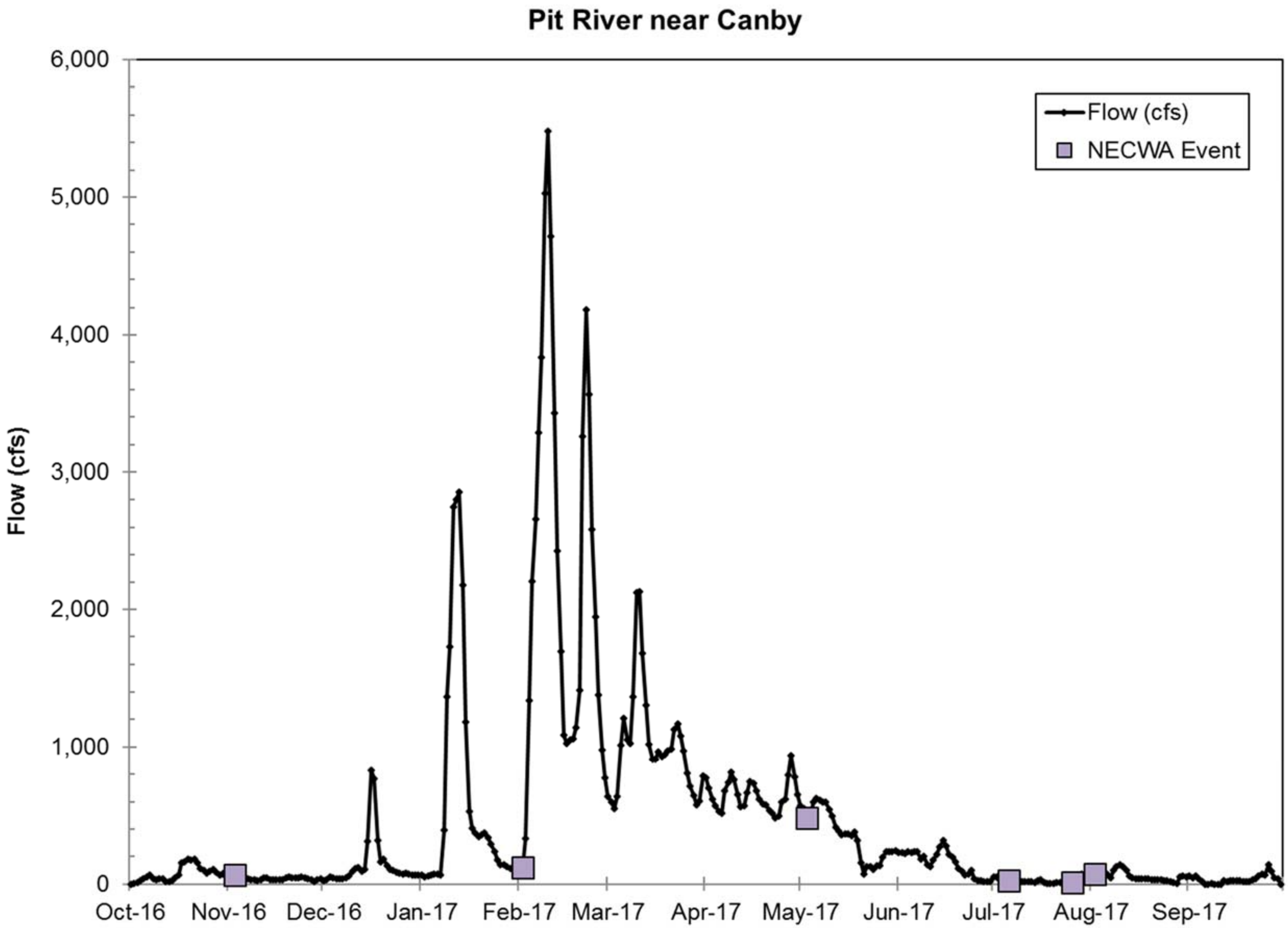

Figure 3-f. Flows during 2017 Coalition Monitoring: Pit River near Canby

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 2016 through September 2017 are included with the related 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. Field and laboratory documentation for samples collected by DWR and RMP are maintained by each entity and are not included in **Appendix B**.

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 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 the AMR. 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, 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 future events to ensure program completeness objectives are met. Sample containers that were received broken are summarized below:

Sample shipments for October 2016 through September 2017 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 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 (*BY; Sample* *received at improper temperature*). In each case, the sampling crews are notified and the conditions and shipping procedures are reviewed to attempt to determine the cause of the elevated temperatures.

Sample shipments for October 2016 through September 2017 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 effort are detailed 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 are presented with the tabulated monitoring data.

Table 9. Summary of QA/QC Results for 2017 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
99.5%	97.8%	99.6%	94.1%	100.0%	92.6%	96.9%	100.0%	97.6%

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 and Quality Assurance-evaluated (QA) data are provided in **Appendix C**. These data were previously submitted as part of the Coalition's quarterly data submittals to *ILRP*. Monitoring results collected and verified by DWR and the DRMP are also included in **Appendix C**.

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 and numeric water quality objectives in the Central Valley Basin Plan (CVRWQCB, 2011), subsequent adopted 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 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 2007).

Water quality objectives and other relevant water quality thresholds discussed in this section are summarized in **Table 18** and **Table 19**. Monitored analytes without relevant water quality objectives or *ILRP* Trigger Limits are listed in **Table 20**.

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. The results of these evaluations are discussed below.

Table 10. Adopted Basin Plan and California Toxics Rule Objectives for Analytes Monitored for 2017 Coalition Monitoring

Analyte	Most Stringent Objective(1)	Units	Objective Source(2)
Aldicarb	3	µg/L	CA 1˚ MCL
Aldrin	0.00013	µg/L	CTR
Ammonia, Total as N	narrative	mg/L	Basin Plan
Arsenic, total	50	µg/L	CA 1˚ MCL
Cadmium, dissolved	hardness dependent(3)	µg/L	CTR
Carbofuran	0.4(4)	µg/L	BP
Chlordane, cis	0.00057	µg/L	CTR
Chlordane, trans	0.00057	µg/L	CTR
Chlorpyrifos	0.015	µg/L	Basin Plan
Copper, dissolved	hardness dependent(3)	µg/L	CTR
DDD (o,p' and p,p')	0.00083	µg/L	CTR
DDE (o,p' and p,p')	0.00059	µg/L	CTR
DDT (o,p' and p,p')	0.00059	µg/L	CTR
Diazinon	0.10	µg/L	Basin Plan
Dieldrin	0.00014	µg/L	CTR
Dissolved Oxygen	5	mg/L	Basin Plan
Endosulfan I	110	µg/L	CTR
Endosulfan II	110	µg/L	CTR
Endosulfan sulfate	110	µg/L	CTR
Endrin	0.036	µg/L	CTR
Endrin aldehyde	0.76	µg/L	CTR
HCH	0.0039	µg/L	CTR
Heptachlor	0.00021	µg/L	CTR
Heptachlor epoxide	0.0001	µg/L	CTR
Lead, dissolved	hardness dependent(3)	µg/L	CTR
Malathion	0.1(4)	µg/L	Basin Plan
Methoxychlor	30	µg/L	CA 1˚ MCL
Nitrate, as N	10	mg/L	CA 1˚ MCL
Oxamyl	50	µg/L	CA 1˚ MCL
Parathion, Methyl	0.13(4)	µg/L	Basin Plan
pH	6.5-8.5	-log[H+]	Basin Plan
Selenium, total	5.0	µg/L	CTR
Temperature	narrative	µg/L	Basin Plan
Toxicity, Algae (*Hyalella*) Survival	narrative	µg/L	Basin Plan
Toxicity, Algae (*Selenastrum*) Cell Density	narrative	µg/L	Basin Plan

Analyte	Most Stringent Objective[1]	Units	Objective Source[2]
Toxicity, Water Flea (*Ceriodaphnia*) Survival	narrative	µg/L	Basin Plan
Turbidity	narrative	µg/L	Basin Plan

Notes:
1. For analytes with more than one limit, the most limiting applicable adopted water quality objective is listed.
2. *CA 1˚ 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).

Table 11. Unadopted Water Quality Limits Used to Interpret Narrative Water Quality Objectives for Analytes Monitored for 2017 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
Total Dissolved Solids	500	mg/L	CA Recommended 2˚ MCL
Total Dissolved Solids	450	mg/L	Ayers and Westcott 1988
Azinphos methyl	0.01	µg/L	USEPA NAWQC[2]
Carbaryl	2.53	µg/L	USEPA NAWQC
Dichlorvos	0.085	µg/L	Cal/EPA Cancer Potency Factor
Dimethoate	1	µg/L	CDPH Notification Level[3]
Disulfoton	.05	µg/L	USEPA NAWQC
Diuron	2	µg/L	USEPA Health Advisory
Linuron	1.4	µg/L	USEPA IRIS Reference Dose
Methidathion	0.7	µg/L	USEPA IRIS Reference Dose
Methiocarb	0.5	µg/L	USFW Acute Toxicity
Methomyl	0.52	µg/L	USEPA NAWQC
Phorate	0.7	µg/L	NAS Health Advisory
Phosmet	140	µg/L	USEPA IRIS Reference Dose

Note:
1. Adopted by the Regional Water Board but not approved by State Water Resources Control Board
2. USEPA National Ambient Water Quality Criteria
3. 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.

Table 12. Analytes Monitored for 2017 Coalition Monitoring without Applicable Adopted or Unadopted Limits

Analytes		
% Solids	Fenuron	Oxyfluorfen
Aminocarb	Fluometuron	Phosphorus as P, Total
Barban	Hardness as CaCO3	Propachlor
Benomyl/Carbendazim	Hexazinone	Propham
Aminocarb	Metolachlor	Propoxur
Bromacil	Mexacarbate	Siduron
Chlorothalonil	Monuron	Tebuthiuron
Chloroxuron	Naled	Total Coliforms
Chlorpropham	Neburon	Total Organic Carbon
Diflubenzuron	Orthophosphate, as P	Total Suspended Solids
Discharge (flow)	Oryzalin	

TOXICITY AND PESTICIDE RESULTS

A summary of the toxicity and pesticide results from 2017 Coalition Monitoring is provided in this section.

Toxicity Exceedances in Coalition Monitoring

There were 42 individual toxicity results (including 15 field duplicates) analyzed in water column and sediment samples collected from seven different sites during 2017 Coalition Monitoring. Analyses were conducted for *Selenastrum capricornutum, Ceriodaphnia dubia,* and *Hyalella azteca.* Statistically significant toxicity was not observed in any of the individual toxicity results analyzed by PER in either sediment or water column samples.

The DRMP collected toxicity samples at UCBRD for nine monitoring events: October 2016 through June 2017. Draft DRMP toxicity results show statistically significant toxicity for *Selenastrum capricornutum* during one (November 2016) of these monitoring events. Pesticides concentrations measured in the water sample associated with the *Selenastrum* toxicity event did not exceed WQOs. Pesticide Use Report data and ecotoxicology benchmarks for algae proved inconclusive in identifying a particular pesticide/herbicide that could have been responsible for the observed toxicity.

Pesticides Detected in Coalition Monitoring

There were 376 individual pesticide results (including 127 field duplicates) analyzed in 34 water column samples collected from six different sites, including both Representative and Management Plan or Special Study sites during 2017 Coalition Monitoring. Analyses were conducted for organophosphates, carbamates, organochlorines, benzophenyls, and a variety of herbicides. Within these monitored categories, six different pesticides were detected (8 total detected results, including 4 field duplicates) in three separate samples collected for Coalition monitoring. Approximately 91.2% of samples collected in the 2017 Monitoring Year had no detected pesticides, and greater than 97.9% of all pesticide results were below detection.

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 in the Basin Plan). Only one registered pesticide (dichlorvos) exceeded applicable water quality objectives or *ILRP* Trigger Limits in one monitoring sample.

All pesticides detected in water column samples for 2017 Coalition Monitoring are listed in **Table 13**. Pesticides were compared to relevant numeric and narrative water quality objectives, and to toxicity threshold concentrations published in USEPA's *ECOTOX* Database (USEPA 2007) and International Union of Pure and Applied Chemistry Pesticide Properties Database (IUPAC PPDB). A discussion of these detections and exceedances follows below.

- The insecticide dichlorvos was detected in one sample (and one field duplicate) collected at Pine Creek, which exceeded the Cal/EPA Cancer Potency Objective (0.085 µg/L).
    - Pine Creek (Event 137): There were no reported agricultural applications of dichlorvos or naled (the former a metabolite of naled) in the month prior to the July 18, 2017, exceedance. Pesticide use reports for non-agricultural applications did show that about 45 gallons of a product containing dichlorvos had been applied within the County during the month prior. Although water was present in

the creek, field crews were unable to measure flow at this site. The field crew visually inspected the water body and noted that there was flow, but it was very low (0.1 to 1 cfs). In the preceding weeks before the event, there had been no recorded precipitation. Toxicity tests were not performed during this event

- The herbicide metolachlor was detected in one sample (and one field duplicate) collected at Pine Creek. There is currently no *ILRP* Trigger Limit or adopted water quality objective for metolachlor.
- The herbicide naled was detected in one sample (and one field duplicate) at Pine Creek. There is currently no *ILRP* Trigger Limit or adopted water quality objective for naled. The insecticide is analytically indistinguishable from dichlorvos, which does have an ILRP Trigger Limit.
- The herbicide oxyfluorfen was detected in one sample (and one field duplicate) at Gilsizer Slough. There is currently no *ILRP* Trigger Limit or adopted water quality objective for oxyfluorfen.

Table 13. Pesticides Detected in 2017 Coalition Monitoring

Site ID	Date	Analyte	Result[(1)] (µg/L)		Trigger Limit[(2)]	Basis for Limit[(3)]
PNCHY	**7/18/2017**	**Dichlorvos**	**=**	**0.5**	**0.085**	**Cal/EPA**
PNCHY	**7/18/2017**	**Dichlorvos[4]**	**=**	**0.41**	**0.085**	**Cal/EPA**
PNCHY	9/20/2017	Metolachlor[4]	=	1.3	NA	
PNCHY	9/20/2017	Metolachlor	=	1.5	NA	
PNCHY	7/18/2017	Naled	=	0.5	NA	
PNCHY	7/18/2017	Naled[4]	=	0.41	NA	
GILSL	2/21/2017	Oxyfluorfen	=	0.12	NA	
GILSL	2/21/2017	Oxyfluorfen[4]	=	0.11	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 Regional Board; USEPA Health Advisory = Drinking water health advisory.
4. Field duplicate sample
5. CA 1˚ MCLs are California's Maximum Contaminant Levels for treated drinking water;

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, and trace metals during 2017 Coalition Monitoring (see **Table 14**).

Specific Conductivity

Specific conductivity was monitored in 76 samples from 18 Coalition sites. Specific conductivity exceeded the unadopted UN Agricultural Goal (700 µS/cm) in a total of 13 samples and also exceeded the California recommended 2˚ MCL (900 µS/cm) for drinking water in 6 of the 13 samples. Exceedances were observed at 7 of the 18 monitored sites. UCBRD had eight exceedances, while COLDR, FRSHC, GIDLR, MGSLU, WLSPL, and ZDDIX each had one exceedance.

Dissolved Oxygen

During 2017 Coalition Monitoring, dissolved oxygen was measured in 76 samples at 19 Coalition sites; a total of 10 samples exceeded WARM and COLD Basin Plan lower limits. Dissolved oxygen concentrations were below the Basin Plan lower limit of 5.0 mg/L for waterbodies with a WARM designated beneficial use in two samples from two sites, and below the Basin Plan lower limit of 7.0 mg/L for waterbodies with a COLD designated beneficial use in an additional eight samples from six sites.

Dissolved oxygen exceedances were 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 or limit oxygen production by instream algae and also to trap organic particulates that contribute to instream oxygen consumption.

E. coli Bacteria

E. coli bacteria were analyzed in 38 environmental samples and 10 field duplicates from 12 Coalition sites. *E. coli* results exceeded the single sample maximum objective (235 MPN/100mL) in 21 samples (including five field duplicates) from nine different Coalition monitoring locations.

The Basin Plan 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 2017 Coalition Monitoring, pH was measured in 76 samples from 19 Coalition sites. pH exceeded the Basin Plan maximum of 8.5 standard pH units (-log[H+]) in seven samples from three sites, including five exceedances at UCBRD.

The Basin Plan limit for pH is intended to be assessed based on "…*an appropriate averaging period that will support beneficial uses*" (CVRWQCB 2011). 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 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 were likely due primarily to in-stream algal respiration, caused in part by low flows or ponded and stagnant conditions and temperatures sufficient to stimulate algal growth.

Trace Metals

Trace metals monitored during 2017 Coalition Monitoring included both unfiltered metals (total arsenic, boron, and copper) and filtered metals (dissolved copper).

Total trace metals were monitored in 18 environmental samples and ten field duplicate samples from seven Coalition sites, and dissolved metals were monitored in eight environmental samples and four field duplicate samples from four Coalition sites.

Arsenic

Seven total arsenic environmental samples and 6 field duplicate samples were collected from two Coalition sites. Three environmental samples and three field duplicate samples from monitoring site Grand Island Drain near Leary Road (GIDLR) exceeded the California 1˚ MCL 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 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 just upstream of the Grand Island Drain sampling site, if arsenic-based preservatives were used in the wood. A final, but somewhat unlikely source is an arsenic-based additive that may still be used for chicken feed[9] 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

Three (3) total boron environmental samples and three field duplicate samples were collected from one Coalition site. Four total boron samples (including two field duplicate) at WLSPL exceeded the *ILRP* Trigger Limit (700 µg/L, based on Ayers and Westcott).

Boron is a naturally-occurring mineral that is not applied by agriculture, but it is elevated in some irrigation supplies (especially those comprised of groundwater) and soils, and

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

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.

Table 14. Other Physical, Chemical, and Microbiological Parameters Observed to Exceed Numeric Objectives in 2017 Coalition Monitoring

Site ID	Sample Date	Analyte	Units	Result	Trigger Limit(1)	Basis for Limit(2)	Mgmt Plan(3)
GIDLR	1/11/2017	Arsenic	µg/L	12	10	1˚ MCL(5)	Active
GIDLR	1/11/2017	Arsenic	µg/L	12	10	1˚ MCL(5)	Active
GIDLR	4/18/2017	Arsenic	µg/L	14	10	1˚ MCL(5)	Active
GIDLR	4/18/2017	Arsenic	µg/L	15	10	1˚ MCL(5)	Active
GIDLR	9/20/2017	Arsenic	µg/L	13	10	1˚ MCL(5)	Active
GIDLR	9/20/2017	Arsenic	µg/L	13	10	1˚ MCL(5)	Active
WLSPL	4/18/2017	Boron	µg/L	1300	700	Narrative	Active
WLSPL	4/18/2017	Boron	µg/L	1300	700	Narrative	Active
WLSPL	8/15/2017	Boron	µg/L	1400	700	Narrative	Active
WLSPL	8/15/2017	Boron	µg/L	1400	700	Narrative	Active
UCBRD	11/16/2016	Specific Conductivity	µS/cm	1126	700, 900 (4)	Narrative	Active
WLSPL	12/15/2016	Specific Conductivity	µS/cm	1088	700, 900 (4)	Narrative	Active
UCBRD	3/14/2017	Specific Conductivity	µS/cm	888	700, 900 (4)	Narrative	Active
COLDR	3/21/2017	Specific Conductivity	µS/cm	767	700, 900 (4)	Narrative	Active
GIDLR	4/18/2017	Specific Conductivity	µS/cm	933	700, 900 (4)	Narrative	Active
ZDDIX	4/18/2017	Specific Conductivity	µS/cm	875	700, 900 (4)	Narrative	Active
FRSHC	4/19/2017	Specific Conductivity	µS/cm	784	700, 900 (4)	Narrative	Active
UCBRD	4/25/2017	Specific Conductivity	µS/cm	858	700, 900 (4)	Narrative	Active
UCBRD	5/16/2017	Specific Conductivity	µS/cm	896	700, 900 (4)	Narrative	Active
UCBRD	6/13/2017	Specific Conductivity	µS/cm	712	700, 900 (4)	Narrative	Active
UCBRD	7/18/2017	Specific Conductivity	µS/cm	1058	700, 900 (4)	Narrative	Active
MGSLU	7/19/2017	Specific Conductivity	µS/cm	1141	700, 900 (4)	Narrative	Active
UCBRD	8/15/2017	Specific Conductivity	µS/cm	959	700, 900 (4)	Narrative	Active
LHNCT	10/18/2016	Dissolved Oxygen	mg/L	6.16	7	BP [SSO COLD]	Active
PNCHY	10/18/2016	Dissolved Oxygen	mg/L	4.5	7	BP [SSO COLD]	Active
COLDR	11/16/2016	Dissolved Oxygen	mg/L	6.18	7	BP [SSO COLD]	Active
MGSLU	7/19/2017	Dissolved Oxygen	mg/L	3.37	7	BP [SSO COLD]	Active
PRPIT	5/3/2017	Dissolved Oxygen	mg/L	6.7	7	BP [SSO COLD]	Active
COLDR	8/15/2017	Dissolved Oxygen	mg/L	5.5	7	BP [SSO COLD]	Active
SSKNK	8/15/2017	Dissolved Oxygen	mg/L	4.92	5	BP [SSO WARM]	Active
WLSPL	8/15/2017	Dissolved Oxygen	mg/L	5.4	7	BP [SSO COLD]	Active
MDLCR	8/16/2017	Dissolved Oxygen	mg/L	6.86	7	BP [SSO COLD]	Active
GIDLR	9/20/2017	Dissolved Oxygen	mg/L	4.1	5	BP [SSO WARM]	Active
PNCHY	9/20/2017	Dissolved Oxygen	mg/L	4.8	7	BP [SSO COLD]	Active
FRSHC	12/15/2016	E. coli	MPN/100mL	410.6	235	BP	Suspended
FRSHC	12/15/2016	E. coli	MPN/100mL	410.6	235	BP	Suspended
GIDLR	1/11/2017	E. coli	MPN/100mL	2419.6	235	BP	Suspended
GIDLR	1/11/2017	E. coli	MPN/100mL	2419.6	235	BP	Suspended
WLSPL	1/11/2017	E. coli	MPN/100mL	2419.6	235	BP	Suspended

Site ID	Sample Date	Analyte	Units	Result	Trigger Limit(1)	Basis for Limit(2)	Mgmt Plan(3)
LSNKR	3/21/2017	E. coli	MPN/100mL	>2419.6	235	BP	Suspended
LSNKR	3/21/2017	E. coli	MPN/100mL	>2419.6	235	BP	Suspended
WLKCH	3/22/2017	E. coli	MPN/100mL	488.4	235	BP	Suspended
LHNCT	4/18/2017	E. coli	MPN/100mL	579.4	235	BP	Suspended
PNCHY	4/18/2017	E. coli	MPN/100mL	313	235	BP	Suspended
GIDLR	4/18/2017	E. coli	MPN/100mL	410.6	235	BP	Suspended
FRSHC	4/19/2017	E. coli	MPN/100mL	387.3	235	BP	Suspended
FRSHC	4/19/2017	E. coli	MPN/100mL	410.6	235	BP	Suspended
ACACR	5/16/2017	E. coli	MPN/100mL	307.6	235	BP	Suspended
ACACR	7/19/2017	E. coli	MPN/100mL	1732.9	235	BP	Suspended
UCBRD	8/15/2017	E. coli	MPN/100mL	248.1	235	BP	Suspended
WLSPL	8/15/2017	E. coli	MPN/100mL	>2419.6	235	BP	Suspended
FRSHC	8/16/2017	E. coli	MPN/100mL	648.8	235	BP	Suspended
ACACR	9/20/2017	E. coli	MPN/100mL	285.1	235	BP	Suspended
WLKCH	9/20/2017	E. coli	MPN/100mL	1413.6	235	BP	Suspended
WLKCH	9/20/2017	E. coli	MPN/100mL	1553.1	235	BP	Suspended
WLSPL	12/15/2016	pH	std. units	8.61	6.5-8.5	BP	Active
UCBRD	3/14/2017	pH	std. units	8.77	6.5-8.5	BP	Active
UCBRD	4/25/2017	pH	std. units	8.72	6.5-8.5	BP	Active
UCBRD	5/16/2017	pH	std. units	8.72	6.5-8.5	BP	Active
UCBRD	6/13/2017	pH	std. units	8.72	6.5-8.5	BP	Active
WLKCH	7/18/2017	pH	std. units	8.68	6.5-8.5	BP	Active
FRRRB	8/3/2017	pH	std. units	8.60	6.5-8.5	BP	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 Regional Board.
3. Indicates whether sites and parameter are currently being addressed by an ongoing management plan, study, or TMDL
4. Specific conductivity exceeded the unadopted UN Agricultural Goal (700 µS/cm) and/or the California recommended 2˚ MCL (900 µS/cm) for drinking water.
5. CA 1˚ MCLs are California's Maximum Contaminant Levels for treated drinking water;

Trend Analysis

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

> *"… identify potential trends[10] 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 2014 AMR, the Coalition conducted the trend analysis for all representative monitoring sites, as well as all pesticides that were detected with ≥5% detection[11]. From this dataset, it was determined that the sites and constituents shown in **Table 15** had potential to degrade water quality.

Table 15. Significant Trends Further Evaluated for Potential Degradation of Water Quality (2014)

Category	Analyte	Site Name
Physical	Specific Conductivity	Anderson Creek at Ash Creek Road
		Colusa Basin Drain above KL
		Freshwater Creek at Gibson Rd
		Lower Snake R. at Nuestro Rd
		Middle Creek u/s from Highway 20
		North Canyon Creek
		Pine Creek at Nord Gianella Road
		Pit River at Pittville
		Sacramento Slough bridge near Karnak
		Ulatis Creek at Brown Road
		Walker Creek near 99W and CR33
		Willow Slough Bypass at Pole Line
	Dissolved Oxygen	Coon Creek at Brewer Road
		Lower Snake R. at Nuestro Rd
		Middle Creek u/s from Highway 20
		Middle Fork Feather River above Grizzly Cr
		Pine Creek at Highway 32

[10] "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."

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

Category	Analyte	Site Name
		Pine Creek at Nord Gianella Road
		Ulatis Creek at Brown Road
	pH	Colusa Basin Drain above KL
		Lower Snake R. at Nuestro Rd
		Pope Creek upstream from Lake Berryessa
	Temperature	Middle Creek u/s from Highway 20
	Total Organic Carbon	Pine Creek at Nord Gianella Road
		Walker Creek near 99W and CR33
	Total Suspended Solids	Grand Island Drain near Leary Road
Nutrients	Ammonia, Total as N	Pine Creek at Nord Gianella Road
	Nitrate+Nitrite, as N	Freshwater Creek at Gibson Rd
	Orthophosphate, as P	Lower Honcut Creek at Hwy 70
		Pine Creek at Nord Gianella Road
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 2014. This approach was approved by the Regional Water Board for the second year of an Assessment period and for non-Assessment years. 2017 was a non-Assessment period so the trend analysis followed the prioritized approach. The modified trend assessment for 2017 reanalyzed the following:

- High priority pesticides with high detection rates
  - Chlorpyrifos
  - Diazinon
  - Diuron
- Sites with active Management Plans for *Ceriodaphnia* and *Selenastrum*
- Nutrient data for the 2014 sites that were listed in the “potential degradation subsection”

The methods used to analyze and evaluate the data 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, metals, nutrients, pathogen indicators

- 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
    - 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 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 of developing the annual Monitoring Plan Update, as required by the WDR, and no additional evaluations of pesticide use data were conducted for this AMR. The results of pesticide evaluations conducted in 2013 and 2014 were incorporated into the 2014 and 2015 monitoring plans, respectively, that were approved by the Regional Water Board.

DISCUSSION OF RESULTS

The Coalition's 2017 Monitoring Plan Update was approved by Regional Water Board staff as meeting the requirements of the WDR. The WDR provides no additional guidance or criteria for making a determination that there are "deficiencies in monitoring" or that additional locations or events are needed, and none were identified as a result of the trend analysis conducted for this report.

Summary of initial Spearman's test results

- 19 site-parameter combinations were evaluated
- Nutrients were not part of this evaluation due to a lack of new monitoring data at the sites listed in the 2014 evaluation "potential degradation subsection"
- 11 results were not significant ($p \geq 0.05$)
- Eight results were initially determined to have potentially significant trends ($p < 0.05$)
    - Seven significant results were identified for trends with no potential negative impacts (i.e., they indicated potentially improving water quality)
    - Only one initially significant result was identified as suggesting degradation with potential negative impacts on beneficial uses and was further evaluated

- One result (~5% of the beginning number of evaluations) was determined to have significant increasing trends suggesting potential degradation (**Table 16**) and was evaluated further.

Table 16. Significant Trends Further Evaluated for Potential Degradation

Category	Analyte	Site Name
Pesticide	Chlorpyrifos	Gilsizer Slough

Chlorpyrifos concentrations at Gilsizer Slough were elevated above the average for the site between 2014 and 2015 due to four exceedances of the WQO for chlorpyrifos (**Figure 4**), which triggered a Management Plan in 2015. Results for 2017 Monitoring Year were below objectives. Risk of degradation and need for tracking are addressed by the Management Plan and ongoing monitoring.

In summary, the results of trend analyses conducted for this AMR did not indicate a need for any additional locations, events, or parameters. The Coalition recommends that these evaluations are conducted no more often than once per assessment period.

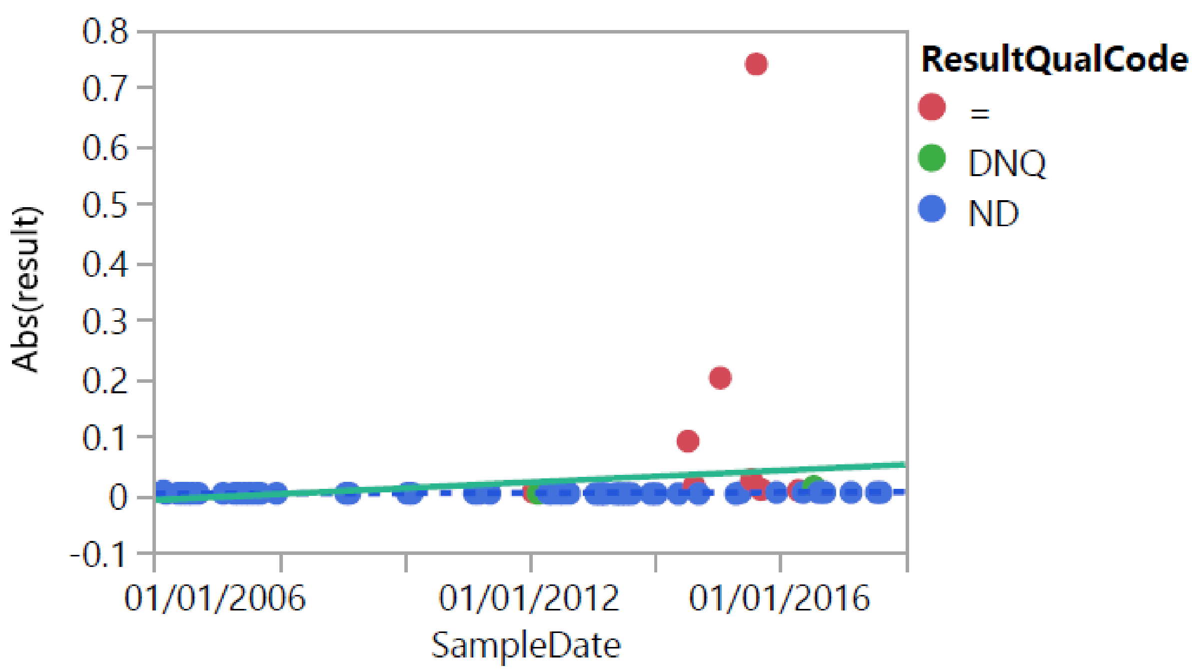

Figure 4. Chlorpyrifos, Gilsizer Slough

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 Regional 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 Coalition subsequently developed an updated Comprehensive Surface Water Quality Management Plan[12] (CSQMP) in 2015 to comply with specific requirements of the current WDR. Implementation of the CSQMP is the primary mechanism for addressing exceedances observed in the Coalition's *ILRP* surface water monitoring.

Management Plan Status Update

The Management Plan Progress Report (MPPR), documenting the status and progress toward meeting Management Plan requirements for 2017, is provided to the Regional Water Board with this Annual Monitoring Report. Activities conducted in 2017 to implement the Coalition's Management Plan included addressing exceedances of objectives for registered pesticides, development of new Management Plans, evaluation of existing Management Plans that could be deemed complete, and monitoring required for 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 Management Plans for registered pesticides and identified causes of toxicity. Beginning in 2015, these surveys were replaced with data compiled from Coalition Member Farm Evaluations. Farm Evaluation 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.

LANDOWNER OUTREACH EFFORTS

The Coalition and its subwatersheds, working with the Coalition for Urban/Rural Environmental Stewardship (CURES), stand committed to working with the Regional 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 standards. Notifications are focused on (but not limited to) growers who operate directly adjacent to or within close proximity to the waterway. The broader outreach program, which includes both grower meetings and the notifications distributed through direct mailings, encourages the

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[12] *SVWQC Comprehensive Surface Water Quality Management Plan. Prepared for the Sacramento Valley Water Quality Coalition (SVWQC) by Larry Walker Associates, Davis, California. June 2015.*

adoption of 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 and *ILRP* Trigger Limits have been observed. 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, the Coalition identifies its members and mails to them an advisory notice along with information on how to address the specific exceedances using BMPs. This same approach was also used to conduct management practice surveys in areas targeted by the 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 watershed in **Appendix F**. Available outreach materials are also included as attachments in **Appendix F**.

Summary of Farm Evaluation Data

The WDR requires that the Coalition collect and aggregates summarized information from Farm Evaluations. The summary of the management practice data includes:

- A data quality assessment of the information by township
- description of corrective actions to be taken regarding any deficiencies in the quality of data submitted

This information is provided as a separate report (Farm Evaluation Summary Report) developed by Michael L. Johnson, LLC (MLJ) for the SVWQC. The 2017 Farm Evaluation Summary Report will be submitted to the Regional Water Board by May 1, 2018.

Conclusions and Recommendations

The Coalition submits this *2017 Annual Monitoring Report* (AMR) as required under the Regional Water Board's Irrigated Lands Regulatory Program (*ILRP*). The AMR provides a detailed description of the Coalition's monitoring results as part of its ongoing efforts to characterize irrigated agricultural and wetlands related water quality in the Sacramento River Basin.

To summarize, the results from the *ILRP* monitoring conducted in 2017 continue to indicate that with few exceptions, there are no major water quality problems with agricultural and managed wetlands discharges 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 2016 through September 2017. To date, a total of 139 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 2016 through September 2017), samples were collected for ten scheduled monthly events and 2 wet weather ("storm") events.

Pesticides were infrequently detected (~2.1% of all pesticide results for 2017 were detected), and, when detected, rarely exceeded applicable objectives. Only one registered pesticide, dichlorvos, exceeded applicable water quality objectives or *ILRP* Trigger Limits during the current monitoring year.

Many of the pesticides specifically required to be monitored in the past by the *ILRP* have rarely been detected in Coalition water samples, including glyphosate, paraquat, and all of the pyrethroid pesticides. Over 98.5% of all pesticide analyses performed to date for the Coalition have been below detection. Coalition monitoring of pesticides for the *ILRP* for 2017 was conducted based on Management Plan requirements for the subwatersheds. The Coalition also conducted monitoring of the *ILRP*-required trace elements (arsenic and copper) 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 pesticides and 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, 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 required elements 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 these documents were approved by the Regional Water Board. Subsequent revisions requested by the Regional 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 the monitoring program based on the knowledge gained through *ILRP* monitoring efforts.

The 2017 monitoring program was developed to be consistent with the requirements of the current WDR and MRP (*Order No. R5-2014-0030*) and was approved by the Regional Water Board for this purpose with the understanding that it would serve as the second "Non-Assessment" monitoring period for the new MRP. 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 previously approved Management Plan while updating the CSQMP in 2016. Throughout this process, the Coalition has kept an open line of communication with the Regional 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

Amweg, E.L., D.P. Weston, and N.M. Ureda. 2005. Use and toxicity of pyrethroid pesticides in the Central Valley, California, USA. Environ Toxicol Chem 24:966-972.

CVRWQCB 2011. The Water Quality Control Plan (Basin Plan) for the California Regional Water Quality Control Board: Central Valley Region (CVRWQCB), the Sacramento River Basin and the San Joaquin River Basin (4th Edition, Revised). Sacramento, California. October.

CVRWQCB 2002. Amendment to The Water Quality Control Plan for The Sacramento River and San Joaquin River Basins for Bacteria. Staff Report and Functional Equivalent Document, *Draft, May 2002*. California Regional Water Quality Control Board – Central Valley Region (CVRWQCB). Sacramento, California.

SVWQC 2010. Quality Assurance Project Plan (QAPP), Sacramento Valley Water Quality Coalition Monitoring and Reporting Program Plan – Sacramento River Basin. Prepared for the Sacramento Valley Water Quality Coalition by Larry Walker Associates, Davis, California.

USEPA 1986. Quality Criteria for Water. EPA 440-5-86-001. U.S. Environmental Protection Agency (USEPA), Office of Water. Washington DC.

USEPA 1999. National Recommended Water Quality Criteria—Correction. EPA 822-Z-99-001. U.S. Environmental Protection Agency (USEPA), Office of Water. Washington, DC.

USEPA 2000. Final California Toxics Rule (CTR), Vol. 65, No. 97, Federal Register, §§31682 *et seq.*.

USEPA 2002a. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, Fifth Edition. Office of Water, Washington, D.C. EPA-821-R-02-012

USEPA 2002b. Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, Fourth Edition. U.S. Environmental Protection Agency (USEPA), Office of Water, Washington, D.C. EPA-821-R-02-01

USEPA 2007. ECOTOX User Guide: ECOTOXicology Database System. Version 4.0. U.S. Environmental Protection Agency. Available: http:/www.epa.gov/ecotox/

USEPA, *Quality Criteria for Water,* EPA 440/9-76-023. U.S. Environmental Protection Agency (USEPA), Office of Water. July, 1976 [*The Red Book*].

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