Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Watershed Monitoring and Assessment Program

Urban Creeks Monitoring Report
Part C: Pesticides & Toxicity Monitoring Status Report

Water Year 2024 (October 2023 – September 2024)

Submitted in compliance with provision C.8.h.iii.(3) of NPDES Permit No. CAS612008, Order No. R2-2022-018

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EOA inc.

This report is submitted by the agencies participating in the

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

City of Campbell	City of Milpitas	City of Santa Clara
City of Cupertino	City of Monte Sereno	City of Saratoga
City of Los Altos	City of Mountain View	City of Sunnyvale
Town of Los Altos Hills	City of Palo Alto	County of Santa Clara
Town of Los Gatos	City of San José	Valley Water

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Prepared for:

Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP)

Prepared by:

EOA, Inc.
1410 Jackson St., Oakland, CA 94612

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LIST OF ACRONYMS

ACCWP	Alameda Countywide Clean Water Program
BAMSC	Bay Area Municipal Stormwater Collaborative
BASMAA	Bay Area Stormwater Management Agency Association
CCCWP	Contra Costa Clean Water Program
CEDEN	California Environmental Data Exchange Network
DF	Detection Frequency
DPR	(California) Department of Pesticide Regulation
DQO	Data Quality Objective
FY	Fiscal Year
IMR	Integrated Monitoring Report
IPM	Integrated Pest Management
LID	Low Impact Development
MDL	Method Detection Limit
MPC	Monitoring and Pollutants of Concern
MRP	Municipal Regional Permit
NPDES	National Pollutant Discharge Elimination System
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PEC	Probable Effects Concentrations
PRM	Pathogen Related Mortality
PUR	(California) Pesticide Use Reporting
QAPP	Quality Assurance Project Plan
QAPrP	Quality Assurance Program Plan
QA/QC	Quality Assurance/Quality Control
RMC	Regional Monitoring Coalition
SCCWRP	Southern California Coastal Water Research Project
SCVURPPP	Santa Clara Valley Urban Runoff Pollution Prevention Program
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board
SMCWPPP	San Mateo Countywide Water Pollution Prevention Program
SOP	Standard Operating Procedure
SPoT	Stream Pollution Trends Program
SURF	Surface Water Database
SWAMP	Surface Water Ambient Monitoring Program
SWPP	Surface Water Protection Program
TMDL	Total Maximum Daily Load
TEC	Threshold Effects Concentrations
TOC	Total Organic Carbon
TST	Test of Significant Toxicity
TU	Toxicity Unit
UCMR	Urban Creeks Monitoring Report
USEPA	United States Environmental Protection Agency
WQO	Water Quality Objective
WY	Water Year

1.0 INTRODUCTION

This *Urban Creeks Monitoring Report (UCMR) Part C: Pesticides & Toxicity Monitoring Status Report*, *Water Year*[1] *(WY) 2024* was prepared by the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP or Program), on behalf of its 15 member agencies (13 cities/towns, the County of Santa Clara, and Valley Water), which are subject to the National Pollutant Discharge Elimination System (NPDES) stormwater permit for Bay Area municipalities referred to as the Municipal Regional Permit (MRP).

The MRP was first adopted by the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB or Regional Water Board) on October 14, 2009 as Order R2-2009-0074 (SFBRWQCB 2009; referred to as MRP 1.0). On November 19, 2015, the Regional Water Board updated and reissued the MRP as Order R2-2015-0049 (SFBRWQCB 2015; referred to as MRP 2.0). The current, and third version of the MRP (i.e., MRP 3.0, SFBRWQCB 2022) was issued by the Regional Water Board as Order R2-2022-0018 and became effective July 1, 2022.

This report fulfills the requirements of provision C.8.h.iii.(3) of MRP 3.0 for interpreting and reporting all pesticides and toxicity monitoring data collected during WY 2024 by SCVURPPP. This report builds on the interpretation and reporting on pesticides and toxicity monitoring data that were provided in the March 2020 Integrated Monitoring Report (IMR) (SCVURPPP 2020) and UCMRs from WYs 2016 through 2023 (SCVURPPP 2017 through 2024).[2]

Data presented in this report were collected pursuant to water quality monitoring requirements in provision C.8.g (pesticides and toxicity monitoring) of the MRP.[3] Data presented in this report were submitted electronically to the Regional Water Board by SCVURPPP and may be obtained via the California Environmental Data Exchange Network (CEDEN).

1.1 Report Organization

This report is organized into the following sections:

- **Section 1.0** provides the relevant background information and regulatory requirements for pesticides and toxicity monitoring pursuant to the MRP.
- **Section 2.0** presents the methodology of pesticides and toxicity monitoring conducted by the Program in WY 2024, including brief descriptions of sampling protocols and analytical methods and a statement of data quality.
- **Section 3.0** discusses the results based on WY 2024 monitoring data.
- **Section 4.0** discusses conclusions and recommendations based on all pesticides and toxicity monitoring for SCVURPPP since WY 2016.
- **Section 5.0** provides all references cited in this report.

[1] Most hydrologic monitoring occurs for a period defined as a Water Year, which begins on October 1 and ends on September 30 of the named year. For example, Water Year 2023 (WY 2024) began on October 1, 2023 and concluded on September 30, 2024.

[2] Prior monitoring reports prepared by SCVURPPP are available at scvurppp.org.

[3] Monitoring data collected pursuant to other C.8 provisions (e.g., Pollutants of Concern Monitoring, Low Impact Development (LID) Monitoring, and Trash Monitoring) are reported in other parts of the SCVURPPP Urban Creeks Monitoring Reporting series (UCMR) for WY 2024.

1.2 Monitoring Requirements

Toxicity testing provides a tool for assessing the toxic effects (acute and chronic) of all chemicals in samples of receiving waters or sediments, and allows the cumulative effect of the pollutants present in the sample to be evaluated. Because different test organisms are sensitive to different classes of chemicals and pollutants, toxicity testing is conducted using several different organisms. Sediment and water chemistry analysis for a variety of potential pollutants is conducted synoptically with toxicity testing to provide preliminary insight into the possible causes of toxicity should it be observed.

Provision C.8.g of the MRP requires Permittees to conduct wet and dry weather monitoring of pesticides and toxicity in urban creeks.

1.2.1 Dry Weather

Provision C.8.g.ii of the MRP requires the Program to collect two samples each year during dry weather for toxicity and sediment chemistry analysis. Dry weather monitoring includes:

- Toxicity testing in water using five species: *Ceriodaphnia dubia* (chronic survival and reproduction), *Pimephales promelas* (larval survival and growth), *Selenastrum capricornutum* (growth), *Hyalella azteca* (survival) and *Chironomus dilutus* (survival).
- Toxicity testing in sediment using two species: *Hyalella azteca* (survival) and *Chironomus dilutus* (survival).
- Sediment chemistry analysis for pyrethroids (bifenthrin, cyfluthrin, cypermethrin, deltamethrin, esfenvalerate, lambda-cyhalothrin, permethrin), fipronil and its degradates (fipronil-sulfone, fipronil-desulfinyl, fipronil sulfide), total polycyclic aromatic hydrocarbons (PAHs), metals (arsenic, cadmium, chromium, copper, lead, nickel, zinc), total organic carbon (TOC), and sediment grain size.

1.2.2 Wet Weather

Provision C.8.g.iii of the MRP requires Permittees to collect samples from the water column during storm events for toxicity and pesticide analysis. Sample locations must be representative of urban watersheds (i.e., bottom of watershed locations). Wet weather monitoring includes:

- Toxicity testing in water using five species: *Ceriodaphnia* dubia (chronic survival and reproduction), *Pimephales promelas* (larval survival and growth), *Selenastrum capricornutum* (growth), *Hyalella azteca* (survival) and *Chironomus dilutus* (survival).
- Water chemistry analysis for pyrethroids (bifenthrin, cyfluthrin, cypermethrin, deltamethrin, esfenvalerate, lambda-cyhalothrin, permethrin), fipronil and its degradates (fipronil-sulfone, fipronil-desulfinyl, fipronil sulfide)[4], and imidacloprid[5].

Provision C.8.g.iii provides two options to the determine the number of wet weather samples required. If provision C.8.g.iii sampling is conducted by the Bay Area Municipal Stormwater Collaborative (BAMSC)[6] Regional Monitoring Coalition (RMC) on behalf of all MRP Permittees, a collective total of ten wet weather samples is required, with a minimum of six samples

[4] Fipronil amide is optional.

[5] Imidacloprid must be analyzed using a method that achieves a reporting level of 0.01 ppb.

[6] The BAMSC was organized by the Bay Area Stormwater Management Agencies Association (BASMAA) Board of Directors to continue the information sharing and permittee advocacy functions of BASMAA in an informal manner after BASMAA's dissolution in 2021.

collected by the end of the third water year of the permit term (i.e., WY 2024). If provision C.8.g.iii sampling is conducted by individual countywide stormwater programs, SCVURPPP must collect at least two wet weather samples per year.

Members of the RMC completed wet weather pesticides and toxicity monitoring in WY 2023. SCVURPPP collected three of the ten regional samples. Wet weather results are available in the WY 2023 UCMR (SCVURPPP 2024).

1.2.3 Follow-up

Provision C.8.g.iv of the MRP requires Permittees to provide notification in the next UCMR when analytical results indicate any of the following:

- A toxicity test of growth, reproduction, or survival of any test organism that is reported as “fail” in both the initial sampling and a second, follow-up sampling, and both have ≥ 50% Percent Effect;
- A pollutant is present at a concentration exceeding its water quality objective (WQO) in the Basin Plan; or
- For pollutants without WQOs, results exceed Probable Effects Concentrations (PECs) or Threshold Effects Concentrations (TECs) as defined in MacDonald et al. (2000).

1.3 Regional Monitoring Coalition

Provision C.8.a. (Compliance Options) of the MRP allows Permittees to address monitoring requirements through a regional collaborative effort, their Stormwater Program, and/or individually.[7] The RMC was originally formed in early 2010 as a collaboration among several Bay Area Stormwater Management Agencies Association (BASMAA) members and MRP Permittees[8] to develop and implement regionally coordinated water quality monitoring programs that improve stormwater management in the region and address water quality monitoring required by the MRP. The BAMSC took over coordination of the RMC in 2020 and the collaboration allows Permittees and the Regional Water Board to improve their ability to collectively answer core management questions in a cost-effective and scientifically rigorous way. Participation in the RMC is facilitated through the BAMSC Monitoring and Pollutants of Concern (MPC) Subcommittee.

The goals of the RMC are to:

1. Assist Permittees in complying with requirements in provision C.8 (Water Quality Monitoring) of the MRP;
2. Develop and implement regionally consistent monitoring approaches and designs in the Bay Area, through the improved coordination among RMC participants and other agencies (e.g., Regional Water Board) that share common goals; and
3. Stabilize the costs of creek monitoring by reducing duplication of effort and streamlining reporting.

[7] Provision C.8.g of MRP 3.0 also encourages Permittees to collaborate with the California Department of Pesticide Regulation for data collection and analysis.

[8] The BAMSC RMC partners include SCVURPPP, Alameda Countywide Clean Water Program (ACCWP), Contra Costa Clean Water Program (CCCWP), San Mateo Countywide Water Pollution Prevention Program SMCWPPP, and the Solano Stormwater Alliance (SSA).

2.0 METHODS

Water quality data were collected and reviewed in accordance with California Surface Water Ambient Monitoring Program (SWAMP) comparable methods and procedures described in the RMC Standard Operating Procedures (SOPs; BASMAA 2016) and the associated Quality Assurance Project Plan (QAPP; BASMAA 2020). These documents are updated as needed to optimize applicability. Where applicable, monitoring data were collected using methods comparable to those specified by the SWAMP Quality Assurance Program Plan (QAPrP)[9], and were submitted in SWAMP-compatible format to the Regional Water Board. The SOPs were developed using a standard format that describes health and safety cautions and considerations, relevant training, site selection, and sampling methods/procedures, including pre-fieldwork mobilization activities to prepare equipment, sample collection, and de-mobilization activities to preserve and transport samples.

2.1 Monitoring Methods

Water and sediment samples for pesticides and toxicity monitoring were collected in accordance with SWAMP-comparable methods and procedures described in the RMC SOPs (BASMAA 2016) and the associated QAPP (BASMAA 2020). Before sampling, field personnel conducted a qualitative assessment of the proposed sampling site to identify appropriate sampling locations. This is particularly necessary for sediment sampling, which requires the presence of fine-sediment depositional areas that can support at least five sub-sites within a 100-meter reach.

Water samples were collected using standard grab sampling methods. The required number of labeled bottles were filled and placed on ice to cool to < 6°C. The laboratories were notified of the impending sampling delivery to meet sample hold times. Procedures used for sampling and transporting water samples are described in SOP FS-2 (BASMAA 2016).

Sediment samples were collected after water sample collection. Sediment samples were collected from the top 2 cm at each sub-site beginning at the downstream-most location and continuing upstream. Field staff walk in an upstream direction, carefully avoiding disturbance of sediment at collection sub-sites. Sediment samples were placed in a compositing container, thoroughly homogenized, and then aliquoted into separate jars for chemical or toxicological analysis using standard clean sampling techniques (see SOP FS-6, BASMAA 2016).

Samples were submitted to respective laboratories under RMC SOP FS-9 Chain of Custody procedures and field data sheets were reviewed per SOP FS-13 (BASMAA 2016).

2.2 Laboratory Analysis Methods

The RMC participants, including SCVURPPP, agreed to use the same laboratories for individual parameters, developed standards for contracting with the labs, and coordinated shared quality assurance samples. All samples collected by RMC participants that were sent to laboratories for analysis were analyzed and reported per SWAMP-comparable methods as described in the QAPP (BASMAA 2020). Analytical laboratory methods, reporting limits, and holding times for chemical water quality parameters are also described in the QAPP. Analytical laboratory contractors in WY 2024 included CalTest, Inc. (sediment chemistry) and Pacific EcoRisk, Inc. (water and sediment toxicity).

[9]The current SWAMP QAPrP is available at: https://www.waterboards.ca.gov/water_issues/programs/swamp/docs/swamp-qaprp-2022.pdf

2.3 Data Evaluation

2.3.1 Water and Sediment Toxicity

Toxicity data evaluation required by the MRP involves first assessing whether the samples are toxic to the test organisms relative to the laboratory control treatment via statistical comparison using the Test of Significant Toxicity (TST) statistical approach. For samples with toxicity (i.e., those that "failed" the TST), the Percent Effect is evaluated. The Percent Effect compares sample endpoints (survival, reproduction, growth) to the laboratory control endpoints. Both the statistical comparison (e.g., TST) and the comparison of the sample results to the laboratory control (e.g., Percent Effect) are determined by the laboratory. If a sample is reported as "fail" with ≥ 50% Percent Effect, a follow-up sample is collected. If both the initial and follow-up sample are reported as "fail" with ≥ 50% Percent Effect, the Regional Water Board is notified in the next UCMR.

2.3.2 Sediment Chemistry

In compliance with MRP provision C.8.g.iv, sediment sample results are compared to PECs and TECs as defined by MacDonald et al. (2000). PEC and TEC quotients are calculated as the ratio of the measured concentration to the respective PEC and TEC values from MacDonald et al. (2000). All results where a PEC or TEC quotient is equal to or greater than 1.0 are reported in the next UCMR.

The PECs and TECs are listed in MacDonald et al. (2000) for total PAHs, rather than the individual PAHs that are reported by the laboratory. Total PAH concentrations were calculated by summing the concentrations of the 25 individual PAHs that were measured by SCVURPPP. Concentrations equal to one-half of the respective laboratory method detection limits (MDLs) were substituted for non-detect data so that calculations and statistics could be computed. Therefore, some of the TEC and PEC quotients may be artificially elevated due to the method used to account for filling in non-detect data.

The TECs for bedded sediments are very conservative values that do not consider site specific background conditions and therefore may not be very useful in identifying real water quality concerns in receiving waters. All sites in Santa Clara County are likely to have at least one TEC quotient equal to or greater than 1.0. This is due to high levels of naturally occurring chromium and nickel in local ultramafic geologic formations (i.e., serpentinite) and soils. These conditions are considered when making decisions about follow-up investigations.

The MRP does not specify follow-up actions for pyrethroid or fipronil sediment chemistry data, perhaps because pyrethroids are ubiquitous in the urban environment and little is known about fipronil distribution. However, SCVURPPP computed toxic unit (TU) equivalents for individual pyrethroid results based on available literature values for pyrethroids in sediment LC50 values.[10] Because organic carbon mitigates the toxicity of pyrethroid pesticides in sediments, the LC50 values were derived on the basis of TOC-normalized concentrations. Therefore, the pesticide concentrations as reported by the lab were divided by the measured TOC concentration at each site, and the TOC-normalized concentrations were then used to compute TU equivalents for each constituent. Concentrations equal to one-half of the respective laboratory MDLs were substituted for non-detect data so that these statistics could be computed, potentially resulting in artificially elevated results.

[10] The LC50 is the concentration of a given chemical that is lethal on average to 50% of test organisms.

2.3.3 Statement of Data Quality

A comprehensive Quality Assurance/Quality Control (QA/QC) program was implemented by SCVURPPP covering all aspects of pesticides and toxicity monitoring. QA/QC procedures were implemented as specified in the RMC QAPP (BASMAA 2020) and monitoring was performed according to protocols specified in the RMC SOPs (BASMAA 2016). Both documents were adapted from the methods detailed in the SWAMP QAPrP. In accordance with the QAPP, data were assessed for seven data quality attributes: (1) Representativeness, (2) Comparability, (3) Completeness, (4) Sensitivity, (5) Contamination, (6) Accuracy, and (7) Precision. These seven attributes are compared to Data Quality Objectives (DQOs), which were established to ensure that data collected are of adequate quality and sufficient for the intended uses. DQOs address both quantitative and qualitative assessment of the acceptability of data – representativeness and comparability are qualitative while completeness, sensitivity, precision, accuracy, and contamination are quantitative assessments.

Overall, the results of the QA/QC review suggest that the pesticides and toxicity monitoring data generated during WY 2024 were of sufficient quality in comparison to DQOs described in the QAPP. Some data were flagged in accordance with QA/QC protocols; however, no data were rejected. A detailed QA/QC report for WY 2024 data is included as Appendix A.

3.0 RESULTS AND DISCUSSION

This section describes the results of toxicity testing, sediment chemistry, and pesticide monitoring (collectively referred to as pesticides and toxicity monitoring) conducted during WY 2024 in compliance with provision C.8.g of the MRP. Historical data from the WY 2024 stations and pesticides and toxicity monitoring results from programs external to SCVURPPP are also discussed. External programs' monitoring sites can provide SCVURPPP with valuable data to inform management efforts for Santa Clara Basin urban creeks with respect to achievement of WQOs and support of beneficial uses.

From WY 2016 through WY 2024, dry weather water and sediment toxicity and sediment chemistry monitoring was conducted by SCVURPPP at two sites: Stevens Creek (37.4098, -122.0691) in the City of Mountain View and San Tomas Aquino Creek (37.3886, -121.9685) in the City of Santa Clara (Figure 3.1). In 2010, Stevens Creek was added to the Clean Water Act (CWA) Section 303(d) list of impaired waterbodies due to toxicity in the water column, including toxicity to *H. azteca.* Although no data have recently been published, Water Board staff is analyzing creek toxicity to understand the impairment in preparation for development of a Total Maximum Daily Load (TMDL).[11]

Wet weather sampling requirements were satisfied in WY 2018 and WY 2023 for MRP 2.0 and MRP 3.0, respectively. Wet weather samples were taken at three monitoring locations during both years and included the Stevens and San Tomas Aquino Creek dry weather monitoring sites as well as a location on Calabazas Creek in WY 2018, and a site on the Guadalupe River in WY 2023. The Guadalupe River station (205GUATRM) was selected in coordination with the California Department of Pesticide Regulation's (DPR) Surface Water Protection Program (SWPP). This station is part of DPR's FY 2020-21 *Surface Water Monitoring for Pesticides in Urban Areas of Northern California* (Alvarado 2023). Coordination with the DPR provided the state agency with expanded storm monitoring capabilities and will provide SCVURPPP with additional analytical results when published.

11
https://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/stevenscktoxicity.html#:~:text=Stevens%20Creek%20was%20identified%20in,survival%2C%20growth%2C%20or%20reproduction

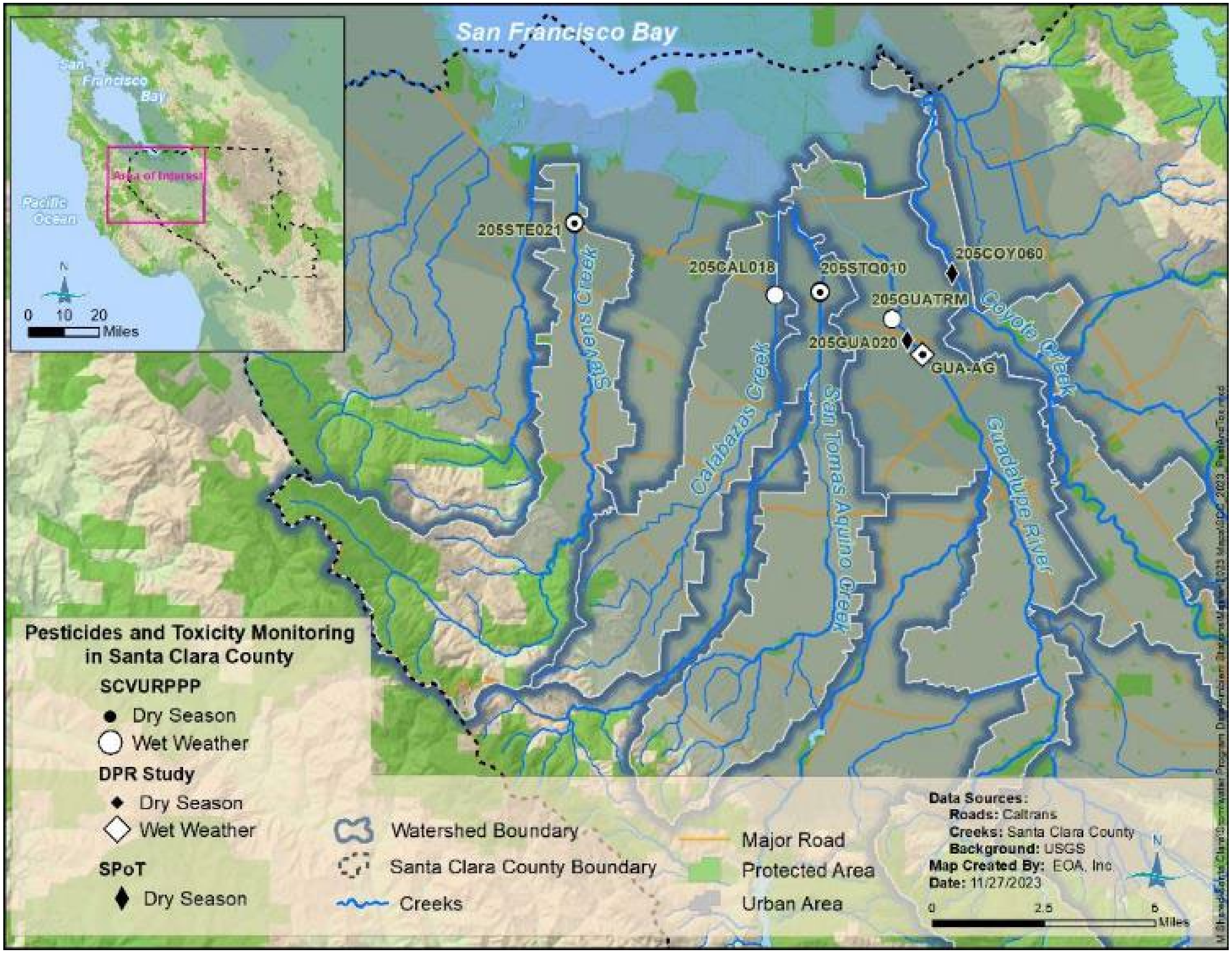

Figure 3.1 Pesticides and toxicity sampling stations in the Santa Clara Basin during WY 2016 through WY 2024.

3.1 Toxicity

3.1.1 WY 2024 Dry Weather Results

Table 3.1 provides a summary of toxicity testing results for water and sediment samples collected during dry weather on July 9, July 22, and September 18, 2024. All sediment and water toxicity samples were originally collected on July 9, 2024. There were two laboratory issues that caused the need to replace the initial water samples for two of the test organisms. The laboratory's *C. dilutus* test organisms were not viable and had to be reordered. The reorder delay resulted in the need to collect replacement water samples for this test. The *P. promelas* samples from July 9 were accidentally mislabeled in the laboratory, also resulting in the need to replace the samples. Both sets of replacement samples were collected on July 22. A pathogen-related mortality event (PRM) resulted in failed toxicity endpoints for all *P. promelas* ambient water samples collected on July 22, 2024. Follow-up testing included an increase in test replicates with fewer test species per replicate to reduce PRM interference. The *P. promelas* retest had no signs of PRM and resulted in a "pass" for all toxicity endpoints. In addition, the *C. dubia* (reproduction) test from the San Tomas Aquino Creek July 9 water sample failed the TST with a 56 Percent Effect, resulting in the need for a follow-up sample which was collected on September 18.

- **San Tomas Aquino Creek (205STQ010).** Of the seven toxicity endpoints, there was just one observation of significant toxicity (*C. dubia* reproduction in water); the Percent Effect was greater than 50% and a resample was collected on September 18, 2024 (Table 3.1) The resampled *C. dubia* result was also significantly toxic with a 58 Percent Effect. The sediment sample was not toxic to either of the test species (*C. dilutus* and *H. azteca*). The cause of the *C. dubia* toxicity in San Tomas Aquino Creek water samples is unknown and does not appear to be explained by the synoptic chemistry results described in Section 3.2.1. See below for further discussion of *C. dubia* toxicity. Sample collection occurred underneath a bridge where there was creek flow (Figure 3.2).

- **Stevens Creek (205STE021).** Of the seven toxicity endpoints, *C. dubia* reproduction in water was the only significantly toxic result for Stevens Creek; however, the Percent Effect was below the 50% MRP trigger for resampling (Table 3.1). See below for further discussion of *C. dubia* toxicity. The sediment sample was not toxic to either of the test species (*C. dilutus* and *H. azteca*). The sample station was accessed via the Stevens Creek trail, south of Highway 101 (Figure 3.3).

Figure 3.2 San Tomas Aquino Creek (205STQ010), downstream view (top left) and upstream view (top right) on July 9, 2024. Resample of 205STQ010, downstream view (bottom left) and upstream view (bottom right) on September 18, 2024 (Photo credit: Kinnetic Environmental, Inc.).

Figure 3.3 Stevens Creek (205STE021), downstream view (left) and upstream view (right), July 9, 2024. (Photo credit: Kinnetic Environmental, Inc.).

Table 3.1 Summary of SCVURPPP dry weather toxicity results for WY 2024. Highlighted cells indicate significant toxicity; bold cells indicate a Percent Effect ≥50%.

Site	Organism	Test Type	Unit	Results		% Effect	TST Value	Follow up needed (TST "Fail" and ≥50%)
				Lab Control	Organism Test			
205STQ010 San Tomas Aquino Creek July 9, 2024	**Water**							
	Ceriodaphnia dubia	Survival	%	100	100	0%	NA [a] (Pass)	No
		Reproduction	Num/Rep	35	15	**56%**	**Fail**	Yes
	Pimephales promelas [b, c]	Survival	%	100	98	3%	Pass	No
		Growth	mg/ind	0.30	0.29	3%	Pass	No
	Chironomus dilutus [b]	Survival	%	98	100	-3%	Pass	No
	Hyalella azteca	Survival	%	96	92	4%	Pass	No
	Selenastrum capricornutum	Growth	cells/ml	2900000	4298000	-48%	Pass	No
	Sediment							
	Chironomus dilutus	Survival	%	85	83	3%	Pass	No
	Hyalella azteca	Survival	%	93	96	-4%	Pass	No
205STE021 Stevens Creek July 9, 2024	**Water**							
	Ceriodaphnia dubia	Survival	%	100	90	10%	NA [a] (Pass)	No
		Reproduction	Num/Rep	35	20	41%	Fail	Yes
	Pimephales promelas [b, c]	Survival	%	100	100	0%	Pass	No
		Growth	mg/ind	0.30	0.29	1%	Pass	No
	Chironomus dilutus [b]	Survival	%	98	90	8%	Pass	No
	Hyalella azteca	Survival	%	96	96	0%	Pass	No
	Selenastrum capricornutum	Growth	cells/ml	2900000	3373000	-16%	Pass	No
	Sediment							
	Chironomus dilutus	Survival	%	85	84	1%	Pass	No
	Hyalella azteca	Survival	%	93	78	16%	Pass	No
205STQ010 San Tomas Aquino Creek September 18, 2024	**Water**							
	Ceriodaphnia dubia	Reproduction	Num/Rep	34	14	**58%**	**Fail**	No

[a] The TST analysis is not performed for survival endpoint - a Percent Effect <25% is considered a "Pass", and a Percent Effect ≥25% is considered a "Fail".

[b] Resampled on July 22, 2024 due to poor quality *C. dilutus* test organisms and to rectify erroneous *P. promelas* labeling.

[c] Pathogen-related mortality (PRM) observed in both *P. promelas* samples collected on July 22, 2024. Follow-up testing included an increased number of replicates (n=20) to reduce contamination.

3.1.2 WY 2016 – WY 2024 Results Summary

Toxicity results from water and sediment samples collected in San Tomas Aquino and Stevens Creek from WY 2016 through WY 2024 are summarized in Table 3.2. These data include the annual dry season samples, as well as six wet weather samples (and three follow-up samples) collected in WY 2018 and WY 2023 in compliance with MRP 2.0 and MRP 3.0. Details of the toxicity tests conducted can be found in the UCMR for each associated year (SCVURPPP 2020 – 2024, 2019a, 2018, and 2017). Details of WY 2019 toxicity test results are compiled with prior years in the Program's MRP 2.0 IMR (SCVURPPP 2020).

From WY 2016 through WY 2024, three sediment samples and nine dry season water samples had significant toxicity relative to the laboratory control *and* a Percent Effect exceeding the MRP evaluation criteria of 50% (see Section 2.3.1 for an explanation of toxicity data evaluation). Forty percent of retested dry season sediment and water samples had confirmed toxicity while twenty percent had significant toxicity and a Percent Effect greater than fifty percent. There were an additional 20 dry season test results where significant toxicity was observed, but the Percent Effect did not exceed the Percent Effect threshold. There were three wet weather samples with toxicity results exceeding the MRP evaluation criteria and three samples with toxicity but a Percent Effect below 50%. None of the wet weather follow-up tests exceeded the Percent Effect threshold.

A review of the nine-year toxicity summary in Table 3.2 reveals several findings:

- ***H. azteca*.** Toxicity to *H. azteca*, a test organism known to be sensitive to pyrethroid pesticides, was observed in WY 2022 and WY 2023 dry season sediment samples, as well as wet weather water samples collected in WY 2018 and WY 2023. Pyrethroid pesticides tend to accumulate in sediment and pyrethroids in sediment samples collected synoptically with the dry season toxicity samples (summarized for WY 2016 – WY 2024 in Table 3.7) sometimes approach or exceed levels of concern (i.e., TU equivalent of 1.0). However, long-term monitoring of local creeks by the Stream Pollution Trends (SPoT) monitoring program suggests that pyrethroid concentrations in sediment have decreased since 2011/2012 (SCVURPPP 2019b). It is unknown whether the toxicity to *H. azteca* observed in WY 2022 and WY 2023 dry season sediment and WY 2018 and WY 2023 wet weather water samples is directly related to pyrethroids or some other toxic substance present in the creeks.
- ***C. dilutus.*** Toxicity to *C. dilutus*, a test organism known to be sensitive to neonicotinoids (e.g., imidacloprid) and fipronil, was observed in five sediment and five water samples collected during the dry season, including three sediment samples from San Tomas Aquino Creek with a Percent Effect exceeding the MRP threshold for resampling. Toxicity to *C. dilutus* was not observed in any of the six wet weather water samples collected in WY 2018 and WY 2023. Although fipronil and its degradates are rarely detected in synoptic sediment chemistry samples, it appears plausible that the water quality impacts associated with pyrethroid pesticides may be decreasing, while impacts associated with their replacements (i.e., neonicotinoids) may be increasing as these types of pesticides have gained market share.
- ***C. dubia* (reproduction).** Of the 32 dry season samples where significant toxicity was observed, half (n=16) were water samples with *C. dubia* reproduction toxicity. The monitoring during WY 2024 had significantly toxic samples from both creeks with a Percent Effect higher than 50% for both the initial and follow-up event in San Tomas Aquino Creek. *C. dubia* is a water flea that is sensitive to a broad range of aquatic

contaminants. However, the specific cause of the chronic *C. dubia* toxicity in San Tomas Aquino and Stevens Creeks is unknown, not seemingly explained by the synoptic sediment chemistry results.

Statewide, there have been other reports of unexplained chronic *C. dubia* toxicity, within and between laboratory variability in the magnitude of toxicity, and suspicion of false positives. An analysis by SWAMP in conjunction with the Statewide Toxicity Provisions adopted by the State Water Board on December 1, 2020 (Resolution NO. 2020-0044) indicates that *C. dubia* toxicity variability could arise from inconsistencies in QA procedures used by laboratories. The final report of a nearly three-year special study requested by the State Water Board and completed by the Southern California Coastal Water Research Project (SCCWRP) was released in September 2023 (Brent et al. 2023). The SCCWRP report investigates levels and sources of variability in lab testing for *C. dubia* toxicity testing. The study also provides recommendations for regulators, regulated parties, and testing laboratories that will enhance the data quality for *C. dubia* toxicity tests and affect stormwater toxicity provisions.

There are many factors that may influence *C. dubia* toxicity test results. The *Ceriodaphnia dubia* Quality Assurance Guidance Recommendations (Study; Brent et al. 2023) investigated laboratory techniques and historical data to better understand how variabilities in test results can be explained and reduced. Laboratory visits and interlaboratory comparisons were also conducted, which found that no two laboratories performed *C. dubia* toxicity testing in the same manner (Brent et al. 2023). Inconsistencies between lab processes on many factors were observed (e.g. recipes for dilution water, food sources, feeding methods, test chambers, volumes, light intensities, health assessments). The Study recommended guidance for laboratory best practices, accreditation, and training. A list of constraints were also provided by the Study that limit the conclusions and recommendations of the Study. Overall, the main concern that was identified in the Study was lab performance, not test methods.

In addition, in preparation for reissuance of the SWAMP QAPrP in 2013, the SWAMP Toxicity Work Group examined conductivity tolerance in freshwater toxicity test species with respect to the relationship between sample water conductivity and observed toxicity. It was determined that *C. dubia* survival and reproduction are negatively affected at high and low conductivities (SWAMP 2013). The SWAMP Toxicity Work Group (2013) recommended “appropriate controls” when sample water has high (>1900 µS/cm) or low (<100 µS/cm) conductivities because the *C. dubia* test organisms cultivated in the laboratory under standard laboratory conditions (e.g., 310 to 360 µS/cm) may perish or experience reduced reproduction when exposed to the sample water. Considering these findings, SCVURPPP compiled the results of conductivity measurements taken from sample water associated with toxicity monitoring from WY 2012 through WY 2020 to compare with the laboratory water used in these toxicity tests and the results of the tests themselves. In almost all cases, it was found that the sample water conductivity was higher or lower by several hundred µS/cm compared to the laboratory control samples (a mean difference of approximately 433 µS/cm). However, no correlation was found between *C. dubia* toxicity and sample water/laboratory control water conductivity differences.

Table 3.2 Toxicity test result summary, WY 2016 – WY 2024. The Percent Effect is indicated for test results with toxicity relative to the lab control. Test results with toxicity exceeding the MRP threshold of 50 Percent Effect are highlighted.

Station ID	Creek	Date	Water Year	Season	Sediment		Water						
					C. dilutus	*H. azteca*	*C. dubia*		*P. promelas*		*C. dilutus*	*H. azteca*	*S. capricornutum*
					Survival	Survival	Survival	Reproduction	Survival	Growth	Survival	Survival	Growth
San Tomas Aquino Creek Dry Season Samples													
205STQ010	San Tomas Aquino Cr	7/11/2016	WY 2016	Dry	**Yes** (18%)	No	No	No	No	No	No	No	No
205STQ010	San Tomas Aquino Cr	7/13/2017	WY 2017	Dry	No	No	No	**Yes** (30%)	No	No	**Yes** (11%)	No	No
205STQ010	San Tomas Aquino Cr	7/17/2018	WY 2018	Dry	No	No	No	No	No	No	No	No	No
205STQ010	San Tomas Aquino Cr	7/23/2019	WY 2019	Dry	**Yes** (56%)	No	No	**Yes** (31%)	No	No	No	No	No
205STQ010	San Tomas Aquino Cr	8/28/2019	WY 2019	Dry [a]	No	--	No	--	--	--	--	--	--
205STQ010	San Tomas Aquino Cr	7/22/2020	WY 2020	Dry	No	No	No	**Yes** (67%)	No	No	**Yes** (31%)	No	No
205STQ010	San Tomas Aquino Cr	9/9/2020	WY 2020	Dry [a]	--	--	--	No	--	--	--	--	--
205STQ010	San Tomas Aquino Cr	6/23/2021	WY 2021	Dry	**Yes** (57%)	No	No	**Yes** (45%)	No	No	No	No	No
205STQ010	San Tomas Aquino Cr	8/18/2021	WY 2021	Dry [a]	--	--	No	No	--	--	--	--	--
205STQ010	San Tomas Aquino Cr	7/12/2022	WY 2022	Dry	**Yes** (100%)	**Yes** (47%)	No	No	No	No	No	No	No
205STQ010	San Tomas Aquino Cr	9/6/2022	WY 2022	Dry [a]	**Yes** (25%)	--	--	--	--	--	--	--	--
205STQ010	San Tomas Aquino Cr	7/18/2023	WY 2023	Dry	**Yes** (47%)	**Yes** (41%)	No	**Yes** (44%)	No	No	No	No	No
205STQ010	San Tomas Aquino Cr	7/9/2024	WY 2024	Dry	No	No	No	**Yes (56%)**	No	No	No	No	No
205STQ010	San Tomas Aquino Cr	9/18/2024	WY 2024	Dry [a]	--	--	--	**Yes (58%)**	--	--	--	--	--
Stevens Creek Dry Season Samples													
205STE021	Stevens Cr	7/11/2016	WY 2016	Dry	No	No	No	No	**Yes** (27%)	No	No	No	No
205STE021	Stevens Cr	7/13/2017	WY 2017	Dry	No	No	No	**Yes** (80%)	No	No	No	No	No
205STE021	Stevens Cr	8/15/2017	WY 2017	Dry [a]	--	--	No	No	--	--	--	--	--
205STE021	Stevens Cr	7/17/2018	WY 2018	Dry	No	No	No	No	No	No	**Yes** (24%)	No	No
205STE021	Stevens Cr	7/23/2019	WY 2019	Dry	No	No	No	**Yes** (73%)	No	No	**Yes** (18%)	No	No
205STE021	Stevens Cr	9/18/2019	WY 2019	Dry [a]	--	--	No	**Yes** (47%)	--	--	--	--	--
205STE021	Stevens Cr	7/22/2020	WY 2020	Dry	No	No	**Yes** (30%)	**Yes** (79%)	No	No	No	No	No
205STE021	Stevens Cr	9/9/2020	WY 2020	Dry [a]	--	--	--	No	--	--	--	--	--
205STE021	Stevens Cr	6/23/2021	WY 2021	Dry	No	No	**Yes** (40%)	**Yes** (57%)	No	No	No	No	No
205STE021	Stevens Cr	8/18/2021	WY 2021	Dry [a]	No	--	--	NA	--	--	--	--	--
205STE021	Stevens Cr	7/12/2022	WY 2022	Dry	No	No	No	**Yes** (24%)	No	No	No	No	No
205STE021	Stevens Cr	7/18/2023	WY 2023	Dry	No	No	No	**Yes** (57%)	No	No	**Yes** (13%)	No	No
205STE021	Stevens Cr	9/11/2023	WY 2023	Dry [a]	--	--	--	**Yes** (54%)	--	--	--	--	--
205STE021	Stevens Cr	7/9/2024	WY 2024	Dry	No	No	No	**Yes** (41%)	No	No	No	No	No
Wet Weather Samples													
205STQ010	San Tomas Aquino Cr	1/8/2018	WY 2018	Wet	--	--	No	No	No	No	No	**Yes** (56%)	No
205STQ010	San Tomas Aquino Cr	3/1/2018	WY 2018	Wet [a]	--	--	No	--	--	--	--	No	--
205STE021	Stevens Cr	1/8/2018	WY 2018	Wet	--	--	No	No	No	No	No	**Yes** (28%)	No
205CAL018	Calabazas Cr	1/8/2018	WY 2018	Wet	--	--	No	No	No	No	No	**Yes** (60%)	No
205CAL018	Calabazas Cr	3/1/2018	WY 2018	Wet [a]	--	--	No	--	--	--	--	**Yes** (12%)	--
205GUATRM	Guadalupe River	11/8/2022	WY 2023	Wet	--	--	No	No	No	No	No	**Yes** (63%)	No
205GUATRM	Guadalupe River	1/10/2023	WY 2023	Wet [a]	--	--	--	--	--	--	--	**Yes** (40%)	--
205STE021	Stevens Cr	11/8/2022	WY 2023	Wet	--	--	No	No	No	No	No	No	No
205STQ010	San Tomas Aquino Cr	11/8/2022	WY 2023	Wet	--	--	No	No	No	No	No	No	No

[a] Resample.

3.2 Sediment Chemistry

3.2.1 WY 2024 Results

Sediment chemistry results from WY 2024 were evaluated as potential stressors based on TEC and PEC quotients (see Section 2.3.2). The Program also evaluated TU equivalents of pyrethroids and fipronil to inform stormwater management.

Table 3.3 lists concentrations and TEC quotients for sediment chemistry constituents (metals and total PAHs) collected during WY 2024 from Stevens Creek and San Tomas Aquino Creek. The TEC quotients are calculated as the measured concentration divided by the highly conservative TEC value, per MacDonald et al. (2000).[12] The TECs are extremely conservative and are intended to identify concentrations below which harmful effects on sediment-dwelling organisms are unlikely to be observed. Both sites had at least two results with a TEC quotient greater than 1.0 (Table 3.3) – these included the chromium and nickel concentrations detected in both creeks. Zinc was also detected with a quotient greater than 1.0 in San Tomas Aquino Creek. Nickel and chromium are expected in watersheds draining hillsides underlain by serpentine formations, which is a common geological feature in Santa Clara County. Thus, it is not surprising that chromium and nickel TEC quotients were greater than 1.0 at both sites. Previous years' monitoring found similar chromium and nickel concentrations for the two sites (SCVURPPP 2024). Zinc concentrations and TEC quotients in WY 2024 samples were also similar to prior years but had a slightly higher concentration in San Tomas Aquino Creek. Zinc can also be found in ultramafic (heavy metal) geologic formations but could also originate from urban runoff.

Table 3.3 Threshold Effect Concentration (TEC) quotients for WY 2024 sediment chemistry constituents. Bolded values indicate TEC quotient ≥ 1.0.

	TEC	205STE021 Stevens Creek		205STQ010 San Tomas Aquino Creek	
Metals (mg/kg DW)		**Concentration**	**Quotient**	**Concentration**	**Quotient**
Arsenic	9.79	2.60	0.27	2.30	0.23
Cadmium	0.99	0.21	0.21	0.19	0.19
Chromium	43.4	70	**1.61**	44	**1.01**
Copper	31.6	26	0.82	28	0.89
Lead	35.8	9.6	0.27	12	0.34
Nickel	22.7	59	**2.60**	43	**1.89**
Zinc	121	71	0.59	127	**1.05**
PAHs (ug/kg DW)					
Total PAHs	1,610	220	0.136 [ab]	99.8	0.062 [ab]
# Constituents with TEC quotient ≥ 1.0		**2**		**3**	

a. Concentration was below the method detection limit (MDL) for most PAHs. The TEC quotient equivalents calculated using 1/2 MDL.

b. The TEC quotient calculated from some estimated concentrations below the reporting limit (J-flagged).

Table 3.4 lists concentrations and PEC quotients for sediment chemistry constituents (metals and total PAHs) collected in WY 2024. PECs are intended to identify concentrations above

[12] MacDonald et al. (2000) does not provide TEC or PEC values for pyrethroids or fipronil. Pesticides are compared to LC50 values in Table 3.6.

which toxicity to benthic-dwelling organisms are predicted to be probable. There was one PEC quotient that was found to be greater than 1.0 in Stevens Creek. The PEC quotient for nickel, an abundant metal in local serpentine soils, was calculated to be 1.21 (Table 3.4). This result is similar to previous PEC monitoring for SCVURPPP creeks.

Table 3.4 Probable Effect Concentration (PEC) quotients for WY 2024 sediment chemistry constituents. Bolded values indicate PEC quotient ≥ 1.0.

	PEC	205STE021		205STQ010	
		Stevens Creek		San Tomas Aquino Creek	
Metals (mg/kg DW)		**Concentration**	**Quotient**	**Concentration**	**Quotient**
Arsenic	33.0	2.60	0.08	2.30	0.07
Cadmium	4.98	0.21	0.04	0.19	0.04
Chromium	111	70	0.63	44	0.40
Copper	149	26	0.17	28	0.19
Lead	128	9.6	0.08	12	0.09
Nickel	48.6	59	**1.21**	43	0.88
Zinc	459	71	0.15	127	0.28
PAHs (ug/kg DW)					
Total PAHs	22,800	220	0.01 [ab]	99.8	0.004 [ab]
# Constituents with TEC quotient ≥ 1.0		**1**		**0**	

a. Concentration was below the method detection limit (MDL) for most PAHs. The PEC quotient equivalents calculated using 1/2 MDL.

b. The PED quotient calculated from some estimated concentrations below the reporting limit (J-flagged).

Table 3.5 lists the concentrations of pesticides measured in sediment samples collected in WY 2024, TOC-normalized concentrations, and TU equivalents for the pesticides for which there are published LC50 values. Many of the pesticides measured were below MDLs and the TU equivalents were calculated using ½ the MDL concentration. Three pesticides from San Tomas Aquino Creek were detected at quantified concentrations. No individual constituent had a TU equivalent exceeding 1.0. The sum of all measured pyrethroid TUs was 0.7 for Stevens Creek and 0.5 for San Tomas Aquino Creek. The highest TU equivalent was from bifenthrin in Stevens Creek and San Tomas Aquino Creek (0.42 and 0.29, respectively). The cypermethrin concentration in Stevens creek had the third highest TU equivalent (0.11), but it was calculated from a detected but not quantified concentration (J-flagged). Bifenthrin is considered the leading cause of pyrethroid-related toxicity in urban areas (Ruby 2013) and the most-commonly detected insecticide monitored by the DPR's SWPP (Alvarado and McClanahan 2024).

Table 3.5 Pesticide concentrations and calculated toxic unit (TU) equivalents, July 9, 2024.

	Unit	LC50	205STE021 Stevens Creek			205STQ010 San Tomas Aquino Creek		
			Concentration	Normalized to TOC	TU Equivalent	Concentration	Normalized to TOC	TU Equivalent
Total Organic Carbon	%	NA	0.37	NA	NA	2.4	NA	NA
Pyrethroid								
Bifenthrin	µg/g dw	0.52	0.0008 [b]	0.216	0.42	0.004	0.150	0.29
Cyfluthrin, total		1.08	0.0001 [b]	0.032	0.03	0.002	0.075	0.07
Cypermethrin, total		0.38	0.0002 [b]	0.043	0.11	0.0004 [b]	0.018	0.05
Deltamethrin/Tralomethrin		0.79	0.0001 [a]	0.027	0.03	0.0001 [a]	0.004	0.01
Esfenvalerate/Fenvalerate, total		1.54	0.0002 [a]	0.045	0.03	0.0002 [a]	0.007	0.01
Cyhalothrin, Total lambda-		0.45	0.00004 [a]	0.011	0.03	0.0003 [b]	0.013	0.03
Permethrin, Total		10.83	0.0004 [a]	0.099	0.01	0.002	0.096	0.01
				Sum of TU Equivalents	**0.7**		Sum of TU Equivalents	**0.5**
Other MRP Pesticides of Concern								
Fipronil	ng/g dw	306	0.060 [a]	16.22	0.05	0.060 [a]	2.50	0.01
Fipronil Desulfinyl		NA [c]	0.080 [a]	21.62	NA	0.080 [a]	3.33	NA
Fipronil Sulfide		435	0.080 [a]	21.62	0.05	0.080 [a]	3.33	0.01
Fipronil Sulfone		158	0.205 [a]	55.41	0.35	0.205 [a]	8.54	0.05

a. Concentration was below the method detection limit (MDL). TU equivalents calculated using 1/2 MDL.

b. TU equivalent calculated from concentration below the reporting limit (J-flagged).

c. No available LC50 value for Fipronil Desulfinyl.

In compliance with the MRP, a grain size analysis was conducted on both WY 2024 sediment samples (Table 3.6). The Stevens Creek (205STE021) sample was 9.8% fines (i.e., 5.3% clay and 4.5% silt) and the San Tomas Aquino Creek (205STQ010) sample was 49.1% fines (i.e., 16.2% clay and 32.9% silt).

Table 3.6 Summary of grain size for the two locations sampled in Santa Clara County during WY 2024.

Grain Size (%)		205STE021 Stevens Creek	205STQ010 San Tomas Aquino Creek
Clay	<0.0039 mm	5.3%	16.2%
Silt	0.0039 to <0.0625 mm	4.5%	32.9%
Sand	V. Fine 0.0625 to <0.125 mm	7.8%	11.2%
	Fine 0.125 to <0.25 mm	24.6%	14.6%
	Medium 0.25 to <0.5 mm	39.3%	14.7%
	Coarse 0.5 to <1.0 mm	14%	4.3%
	V. Coarse 1.0 to <2.0 mm	4.5%	5.9%
Granule	2.0 to <4.0 mm	1.9%	10.6%
Pebble	Small 4 to <8 mm	0.5%	9.4%
	Medium 8 to <16 mm	0%	16.2%
	Large 16 to <32 mm	0%	0%
	V. Large 32 to <64 mm	0%	0%

Note: Sum of grain size values for both sites is greater than 100% due to the laboratory analytical methods used.

3.2.2 WY 2016 – WY 2024 Summary

From WY 2016 to WY 2024, no sediment samples had PEC quotients that exceeded 1.0 for any analytes other than chromium and nickel. Chromium and nickel are excluded from this PEC/TEC analysis because they are contributed primarily by serpentine formations naturally present in the watersheds where monitoring occurred. Excluding chromium and nickel, there were eight samples in the WY 2016 through WY 2024 dataset with TEC quotients ≥ 1.0, the more conservative of the two sediment chemistry evaluation criteria. The constituents and locations with TEC quotients ≥ 1.0 included:

- Total PAHs from Stevens Creek in WYs 2017 and 2018;
- Zinc from Stevens Creek and San Tomas Aquino Creek in WY 2020;
- Copper from Stevens Creek and San Tomas Aquino Creek in WYs 2020 and 2022;
- Lead and copper from Stevens Creek in WY 2023; and
- Zinc in San Tomas Aquino Creek during WY 2024 monitoring.

Table 3.7 lists TU equivalents for pesticides with LC50s available in the literature and concentrations for pesticides without LC50s for sediment samples collected in WY 2016 - WY 2024. Carbaryl has not been detected in any sample.[13] Fipronil and its degradates[14] (desulfinyl, sulfide, sulfone) have been detected at TOC-normalized concentrations below the LC50 in three samples, both WY 2016 samples and the WY 2020 sample from San Tomas Aquino Creek. The sum-of-pyrethroids TU equivalents ranged from 0.11 (Stevens Creek in WY 2017) to 1.3 (Stevens Creek in WY 2020). Since WY 2016, two samples collected from Stevens Creek in 2016 and 2020 have had a sum-of-pyrethroids TU equivalent ≥ 1.0. The sum-of-pyrethroids TU equivalent ≥ 1.0 for San Tomas Aquino Creek has not been observed, except for WY 2022, which found a sum of 1.7 TU equivalents (Table 3.7). Water Year 2024 had no TU equivalents (individual or summed) greater than 1.0 at either sites. There are no apparent trends in TU equivalents for pesticides in San Tomas Aquino Creek or Stevens Creek between WY 2016 and WY 2024.

[13] Carbaryl was eliminated from the list of required analytes in MRP 3.0.

[14] Fipronil degrades via UV exposure, oxidation, and hydrolysis to form four principal degradates: fipronil desulfinyl, fipronil sulfide, fipronil sulfone, and fipronil amide. The degradates tend to be more stable and persistent than the parent compound; therefore, SCVURPPP added the first three of the degradates to the monitoring program in WY 2017.

Table 3.7 Toxicity Unit (TU) equivalent summary for Santa Clara County sediment samples, WY 2016 – WY 2024. See Table 3.5 for WY 2024 concentration data. Bolded values indicate Sum of pyrethroids.

Analyte			Pyrethroids								Other MRP Pesticides of Concern				
			Bifenthrin	Cyfluthrin	Cypermethrin	Deltamethrin	Esfenvalerate	Lambda-cyhalothrin	Permethrin	**Sum Pyrethroids**	Carbaryl	Fipronil	Fipronil desulfinyl	Fipronil sulfide	Fipronil sulfone
		LC50 [c]	0.52 (µg/g dw)	1.08 (µg/g dw)	0.38 (µg/g dw)	0.79 (µg/g dw)	1.54 (µg/g dw)	0.45 (µg/g dw)	10.83 (µg/g dw)	-	NA [d]	306 (ng/g dw)	NA [d]	435 (ng/g dw)	158 (ng/g dw)
Station ID	**Creek**	**Date**													
205STQ010	San Tomas Aquino	7/11/2016	0.39	0.15	0.15 [b]	0.11 [b]	<MDL	<MDL	0.03	**0.88** [a]	<MDL	0.01 [b]	-	-	-
205STQ010	San Tomas Aquino	7/13/2017	0.07 [b]	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	**0.22** [a]	<MDL	<MDL	<MDL	<MDL	<MDL
205STQ010	San Tomas Aquino	7/17/2018	0.39	0.15	0.15 [b]	0.11 [b]	<MDL	<MDL	0.03	**0.88** [a]	<MDL	<MDL	<MDL	<MDL	<MDL
205STQ010	San Tomas Aquino	7/23/2019	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	**0.43** [a]	<MDL	<MDL	<MDL	<MDL	<MDL
205STQ010	San Tomas Aquino	7/22/2020	0.54	0.08	0.07	<MDL	<MDL	0.06	0.01	**0.77** [a]	<MDL	<MDL	<MDL	<MDL	0.12
205STQ010	San Tomas Aquino	6/23/2021	0.49	0.08	<MDL	<MDL	<MDL	0.04 [b]	<MDL	**0.69** [a]	<MDL	<MDL	<MDL	<MDL	<MDL
205STQ010	San Tomas Aquino	7/12/2022	0.83	0.15	0.28	0.30	<MDL	0.06 [b]	0.03	**1.70** [a]	<MDL	<MDL	<MDL	<MDL	<MDL
205STQ010	San Tomas Aquino	7/18/2023	0.14	0.03	0.06 [b]	0.20	<MDL	0.05 [b]	0.01	**0.50** [a]	NA	<MDL	<MDL	<MDL	<MDL
205STQ010	San Tomas Aquino	7/9/2024	0.29	0.07	0.05 [b]	<MDL	<MDL	0.03 [b]	0.01	**0.50** [a]	NA	<MDL	<MDL	<MDL	<MDL
205STE021	Stevens Creek	7/11/2016	0.78	0.13	0.03 [b]	0.19	<MDL	<MDL	0.03	**1.21** [a]	<MDL	0.01 [b]	-	-	-
205STE021	Stevens Creek	7/13/2017	0.07	<MDL	0.02 [b]	<MDL	<MDL	<MDL	0.002	**0.11** [a]	<MDL	<MDL	<MDL	<MDL	<MDL
205STE021	Stevens Creek	7/17/2018	0.12 [b]	<MDL	0.03 [b]	0.10	<MDL	<MDL	<MDL	**0.29** [a]	<MDL	<MDL	<MDL	<MDL	<MDL
205STE021	Stevens Creek	7/23/2019	0.15 [b]	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	**0.40** [a]	<MDL	<MDL	<MDL	<MDL	<MDL
205STE021	Stevens Creek	7/22/2020	0.59	0.14	0.31	<MDL	<MDL	0.26	<MDL	**1.30** [a]	<MDL	<MDL	<MDL	<MDL	<MDL
205STE021	Stevens Creek	6/23/2021	0.27	0.07	<MDL	0.09	<MDL	<MDL	<MDL	**0.51** [a]	<MDL	<MDL	<MDL	<MDL	<MDL
205STE021	Stevens Creek	7/12/2022	0.37 [b]	0.04 [b]	0.14 [b]	0.32 [b]	<MDL	<MDL	0.03	**0.90** [a]	<MDL	<MDL	<MDL	<MDL	<MDL
205STE021	Stevens Creek	7/18/2023	0.14	0.04	0.04 [b]	<MDL	<MDL	0.03 [b]	0.01	**0.30** [a]	NA	<MDL	<MDL	<MDL	<MDL
205STE021	Stevens Creek	7/9/2024	0.42 [b]	0.03 [b]	0.11 [b]	<MDL	<MDL	<MDL	<MDL	**0.70** [a]	NA	<MDL	<MDL	<MDL	<MDL

dw = dry weight

a. Total calculated using 1/2 MDLs for some individual pyrethroids.

b. The TU equivalents calculated from concentration below the reporting limit (EPA or J-flagged).

c. Sources: Amweg et al. 2005 and Maund et al. 2002 for pyrethroids; Maul et al. 2008 for fipronil compounds

d. No available LC50 value for Carbaryl or Fipronil Desulfinyl.

3.3 Third-Party Monitoring Efforts

Several programs external to SCVURPPP are conducting similar pesticides and toxicity monitoring studies within the region. These studies provide valuable data for comparison against SCVURPPP findings to view water quality in a broader spatial and temporal context.

3.3.1 DPR Surface Water Protection Program (SWPP) Monitoring

The DPR SWPP is one of the largest pesticide monitoring and management efforts currently being undertaken in California. Pesticide studies conducted by the DPR SWPP evaluate the frequency of pesticide detections in water at any concentration and make use of a variety of USEPA Aquatic Life Benchmarks for many pesticide compounds (USEPA 2016). The DPR provides web access to their monitoring reports which contain detailed analyses of USEPA Aquatic Life Benchmark[15] exceedance rates. The DPR also maintains the Surface Water Database (SURF) to provide public access to quantitative pesticide data from a wide array of surface water monitoring studies. This database could be queried in the future to allow for the leverage of DPR monitoring data in more complex analyses of SCVURPPP pesticide data.

While the DPR studies encompass a broader geographic area, a wider range of pesticides, and a larger number of samples compared to the SCVRUPPP monitoring program, DPR findings generally align with SCVURPPP's pesticide monitoring results. For example, bifenthrin has been the most frequently detected pesticide in SCVURPPP samples from WY 2016 to WY 2024 and is also among the most commonly detected insecticides in DPR samples. Additionally, both programs have detected some of fipronil's degradates. However, while DPR studies have identified imidacloprid in Santa Clara County creeks, SCVURPPP, which only analyzes wet weather samples for this pesticide, has not detected it. Both wet weather samples from SCVURPPP and wet and dry weather samples from DPR have revealed pyrethroids and fipronil levels exceeding USEPA benchmarks. In addition, toxicity to the pyrethroid-sensitive *H. azteca* and the fipronil-sensitive *C. dilutus* has been observed in water column and sediment samples in both programs.

The following paragraphs summarize recent DPR studies in urban areas of California.

Fiscal Year (FY) 2017: The DPR conducted two studies in Northern and Southern California that involved pesticides and toxicity monitoring at urban sites in Alameda, Contra Costa, Placer, Sacramento, Santa Clara (Guadalupe River – see Figure 3.1), Los Angeles, Orange, and San Diego Counties. Both water and sediment samples were collected and analyzed for a wide range of pesticide compounds. In both the Northern and Southern California studies, bifenthrin and fipronil were found to be among the most frequently detected pesticides. Additionally, pyrethroid concentrations in water were found to be above their USEPA minimum benchmarks for most samples with the exception of cyfluthrin. The studies also state that the detection frequencies of most pyrethroids have remained consistent over recent years (Budd 2018 and Ensminger 2017).

FY 2018: The DPR conducted two urban monitoring studies in Northern and Southern California that collected water and sediment samples in the same counties sampled during FY 2017. Similar to FY 2017, bifenthrin was among the most frequently detected insecticides in water samples from both the Northern and Southern California FY 2018 studies. In the Northern

[15] USEPA Aquatic Life Benchmarks are estimates of the minimum concentrations of pesticides in water expected to present a risk of concern for freshwater organisms. These benchmarks are informational values used as part of the decision-making process for pesticide registration. They are not regulatory, nor do they automatically become part of a state's water quality standards.

California study, bifenthrin was the most frequently detected insecticide and second most frequently detected compound in water samples with a detection frequency (DF) of 76%. In the Southern California study, bifenthrin was the most frequently detected pyrethroid insecticide and the fifth most frequently detected compound in water samples with a DF of 72%. Fipronil and its degradates were also detected at high rates in water samples from the Northern and Southern California studies. While fipronil itself only had a DF of 48% in the Northern California study, fipronil and its degradates collectively had a DF of 72%. Out of these compounds, fipronil sulfone was found at the highest rate with a DF of 70%. Fipronil was also found at a high rate during the Southern California study with a DF of 76%. Its degradates were also found in a large portion of samples, with fipronil sulfone again being the most found with a DF of 67%. Sediment samples from Northern and Southern California were collected and analyzed for bifenthrin and eight other pyrethroids, but fipronil and its degradates were not measured. In both studies, bifenthrin was detected in all samples and was also responsible for the greatest magnitude of TU equivalents (Budd 2019 and Ensminger 2019).

FY 2019: The DPR collected water and sediment samples in the Northern Californian counties of Alameda, Contra Costa, Placer, Sacramento, and Santa Clara. Bifenthrin and fipronil were the most detected insecticides with 41% DF and 37% DF, respectively. Three of fipronil's five degradates were observed and collectively accounted for 61% DF; when combined with the fipronil DF, fipronil and its degradates had an aggregate 98% DF. Bifenthrin and fipronil both exceeded their lowest USEPA Aquatic Life Benchmarks in 34% of all detections. There were no benchmark exceedances for fipronil degradates, yet fipronil sulfone had a 32% DF. Perhaps the biggest conclusion from this DPR study was the observed differences between outfall and stream monitoring and between wet and dry weather monitoring. Bifenthrin and fipronil detections at storm drain outfalls had 73-91% DFs compared to 23-37% in waterways. There was little observed difference between dry and wet weather events in storm drain outfalls for bifenthrin and fipronil, yet waterways that lacked bifenthrin detections during dry events demonstrated a large increase in bifenthrin detections (up to 70% DF) during wet weather events. Likewise, fipronil had 10% DF in waterways during dry events but increased to 50% DF during wet weather events. Fipronil degradates also exhibited differences in dry and wet weather concentrations. While fipronil desulfinyl had equal DF during dry and wet weather events, fipronil amide and sulfone had a 36 and 34 percentage point increase in DF, respectively (Ensminger 2020).

FY 2020: The DPR collected water and sediment samples in the same Northern Californian counties targeted during FY 2019. The detection frequency for bifenthrin was 60%, imidacloprid was 67%, and fipronil was 33%. Imidacloprid had a DF of 67%. Both bifenthrin and fipronil were observed to exceed their USEPA Aquatic Life Benchmarks in 53% and 27% of all detections, respectively. Three of fipronil's degradates were detected: fipronil sulfone had a 29% DF and exceeded its benchmark 2% of the time; fipronil amide had a 11% DF and fipronil desulfinyl had a 7% DF. Fipronil degradates collectively had a 47% DF and when combined with fipronil, had an aggregate 80% DF (Ensminger 2021).

FY 2021: The DPR collected and analyzed water samples for toxicity and pesticide concentrations and sediment samples for analysis of pyrethroid concentrations. All samples were from Northern Californian urban areas and were collected throughout the fiscal year. Similar to previous years' findings, imidacloprid had the highest DF (68%) while bifenthrin (59%) and fipronil (39%) were the second and third most detected pesticides, respectively. Storm events increased detection frequencies in the top three most detected pesticides by 2 to 4 times their dry weather detection frequencies. Both imidacloprid and bifenthrin were detected more often in waterways than storm drain systems. However, fipronil was detected slightly more frequently in storm drains compared to waterways. Imidacloprid, bifenthrin, and deltamethrin concentrations were all found to be above their lowest USEPA Aquatic Life Benchmarks. Some fipronil concentrations were also found to be above the benchmark. Three of the five fipronil degradates were detected, with sulfone having the highest detections (39%) and amide/desulfinyl both having the second highest (14%). Desulfinyl was detected in one sample at a concentration above the benchmark. All seven pyrethroids were detected in the eight sediment samples. All pyrethroid concentrations in sediment samples exceeded their benchmarks. Toxicity testing using *H. azteca* and *C. dilutus* was conducted on water samples collected from Sacramento storm drains during four events: two storm events and two dry season events. All samples were found to be toxic to both test organisms. Samples collected during wet weather were more toxic to *H. azteca* than *C. dilutus*, and overall, wet weather samples were found to be more toxic than dry weather samples (Alvarado 2023).

FY 2022: The DPR collected and analyzed water and sediment samples from creeks, rivers, and storm drains in Southern California throughout the fiscal year. Imidacloprid was detected in the most water samples (87%) while bifenthrin was detected 83% of the time. Other pyrethroids had DFs mostly between 43% and 47%. Fipronil had a DF of 72% while its degradates had DFs between 6% (sulfide) and 96% (desulfinyl). Six pyrethroid pesticides had concentrations above the minimum USEPA Aquatic Life Benchmark. The exceedance frequency for fipronil was 70% while permethrin was 40%. Ten herbicides were also detected throughout the year, with diuron being the most detected at 83%. Diuron was the only herbicide detected above its benchmark (35% DF). Water toxicity tests were conducted using *H. azteca* and *C. dilutus* with 16 samples from two dry events and one storm event. Ten samples were significantly toxic to *H. azteca*. Three samples were significantly toxic to *C. dilutus*. Seven pyrethroids were analyzed from four sediment samples, which included detections of bifenthrin, deltamethrin, and permethrin in all samples. Bifenthrin was above LC50 levels in 75% of samples, deltamethrin 50%, and cypermethrin and lambda cyhalothrin at 25% of samples. (Budd 2023).

FY 2023: The DPR collected and analyzed water and sediment samples from urban areas of Northern California. Imidacloprid and bifenthrin were the most frequently detected insecticides with a 44% DF. Fipronil had a DF of 16%, deltamethrin (14% DF), permethrin (10% DF), and cyfluthrin (5% DF). All imidacloprid, bifenthrin, and deltamethrin were above their lowest USEPA Aquatic Life Benchmark. Fipronil and permethrin had their benchmarks exceeded 14% and 5%, respectively. Fipronil sulfone had a DF of 25%, desulfinyl (10%DF), and amide (6% DF). Water toxicity tests were conducted using *H. azteca* and *C. dilutus* with samples from three dry events and two storm events. Survival for *H. azteca* from Sacramento area samples was 22 to 80% in dry weather samples and 0 to 14% in wet weather samples. A Bay Area wet weather sample had 78% survival. Survival for *C. dilutus* in dry weather samples was 0 to 78% for the Sacramento area and 69 to 79% for the Bay Area (Alvarado, McClanahan 2024). Bifenthrin and deltamethrin were detected in all 12 dry season sediment samples from the Sacramento area but none of the four samples from the Bay Area. One sample from Santa Clara County contained cypermethrin (Alvarado and McClanahan 2024).

3.3.2 SPoT Monitoring Program

The SWAMP Stream Pollution Trends (SPoT) Monitoring Program conducts annual dry season monitoring (subject to funding constraints) of sediments collected from a statewide network of large rivers. The goal of the SPoT Program is to investigate long-term trends in water quality.

Sites are targeted in bottom-of-the-watershed locations with slow water flow and appropriate micromorphology to allow deposition and accumulation of sediments, which include stations near the mouth of Coyote Creek and the Guadalupe River (Phillips et al. 2014) (Figure 3.1). In most years, sediments are analyzed for toxicity, with metals, polychlorinated biphenyls (PCBs), mercury, organic pollutants, and pesticides (including pyrethroids and fipronil and its degradates) analyzed on a less frequent schedule. The most recent technical report prepared by SPoT program staff was published in 2020 and describes ten-year trends from the initiation of the program in 2008 through 2017 (Phillips et al. 2020).

Toxicity testing of sediment was conducted by SPoT in Santa Clara County watersheds using indicator organisms *H. azteca*, which is sensitive to pyrethroids, and *C. dilutus*, added in 2015 to assess neonicotinoid and fipronil impacts. Toxicity samples were evaluated using the TST statistical approach (Phillips et al. 2020). Data from CEDEN has been reviewed up to 2023. Results are summarized below by test species.

- ***H. azteca***: In the Guadalupe River, strongly significant chronic toxicity was observed in the dataset during monitoring years: 2012, 2013, 2015, 2016, and 2019. Strongly significant acute toxicity has not been observed since 2014, and no acute toxicity has been observed since 2016. In Coyote Creek, both acute and chronic toxicity have been observed but there is a trend of decreasing toxicity. The latest significant acute and chronic toxic results were from a sample collected during 2016.

- ***C. dilutus***: In the Guadalupe River, neither acute nor chronic *C. dilutus* toxicity have been observed since monitoring for this organism began in 2015. In Coyote Creek, significant acute toxicity has not been observed, but moderate (not significant) chronic toxicity was observed in one sample from 2018.

The SPoT sediment toxicity results are different when compared to SCVURPPP monitoring results from Stevens Creek and San Tomas Aquino Creek – especially when considering *C. dilutus* data. However, the MRP does not require SCVURPPP to analyze chronic toxicity endpoints for sediment samples. The Program has detected acute *H. azteca* toxicity (Percent Effect <50) in two sediment samples from San Tomas Aquino during WY 2022 and WY 2023 (Table 3.2). Acute *C. dilutus* toxicity has been observed in six samples from San Tomas Aquino Creek (WYs 2016, 2019, 2021, 2022, and 2023). However, only three of the San Tomas Aquino *C. dilutus* sediment samples had Percent Effects >50. Follow up testing resulted in one not significantly toxic endpoint (WY2019) and one significantly toxic result with a Percent Effect <50 (WY 2022).

The SPoT sediment chemistry results from Guadalupe River and Coyote Creek do not show statistically significant trends in sum-of-pyrethroid concentrations or sum-of-fipronil-and-its-degradates concentrations over the 2008 to 2018 dataset reviewed by Philips et al. (2020). However, pyrethroid and fipronil sums in the ten-year review are greater for Coyote Creek than the Guadalupe River (Phillips et al. 2020). A review of SPoT data from 2008 to 2023 downloaded from CEDEN suggests the following findings that are in line with SCVURPPP data from Stevens Creek and San Tomas Aquino Creek. SPoT pyrethroid data are from 2010 to 2016 and fipronil data are from 2013 to 2022.

- **Coyote Creek.** Dry season pyrethroid concentrations in Coyote Creek sediments peaked in July 2012 (674 ng/g). This concentration was largely driven by cyfluthrin, which was measured at 539 ng/g, a concentration 26 times higher than the next highest cyfluthrin measurement (20.2 ng/g in September 2012) and 90 times higher than the average cyfluthrin concentration in the dataset sans July 2012. In most other years, the individual pyrethroid with the highest concentration in Coyote Creek is bifenthrin. Although fipronil has only been detected twice in Coyote Creek during the years it was monitored by SPoT (2018 and 2020), its degradates (fipronil desulfinyl, fipronil sulfide, fipronil sulfone) are usually found at measurable concentrations, with no obvious long-term trends.

- **Guadalupe River.** Similar to Coyote Creek, sum-of-pyrethroid concentrations in Guadalupe River peaked in 2012 (165 ng/g) but was driven by a high permethrin concentration that year (76 ng/g) rather than cyfluthrin (21.7 ng/g). In most other years, the individual pyrethroid with the highest concentration in Guadalupe River is bifenthrin. Fipronil has not been detected in Guadalupe River, but its degradates (fipronil sulfone, fipronil sulfide, and fipronil desulfinyl) have been detected. A more recent (2019) sample had detections of at least two degradates. A significant decrease in PAHs has also been observed in the Guadalupe River SPoT samples.

4.0 CONCLUSIONS AND RECOMMENDATIONS

This section presents conclusions and recommendations from review of the WY 2024 pesticides and toxicity monitoring data that were generated in compliance with provision C.8.g of the MRP and which are presented in the previous sections of this report.

All monitoring and data validation were conducted using methods consistent with the BASMAA RMC QAPP (BASMAA 2020) and SOPs (BASMAA 2016).

4.1 Conclusions

Toxicity testing of water and sediment samples and sediment chemistry monitoring, collectively referred to as pesticides and toxicity monitoring, was conducted during WY 2024 in compliance with provision C.8.g of the MRP. Dry season samples were collected from Stevens Creek and San Tomas Aquino Creek at the same stations that were monitored for pesticides and toxicity during WY 2016 to WY 2023 under MRP 2.0 and MRP 3.0. Based on initial toxicity testing results, a dry weather water resample was required for the *C. dubia* chronic test in San Tomas Aquino Creek. The resample also resulted in significant toxicity with a Percent Effect >50. Toxicity and chemistry data summaries are in the sections below.

4.1.1 Data Evaluation Summary

Dry weather monitoring requirements include five toxicity test species that are analyzed in water samples and two test species in sediment samples. The test organism *H. azteca*, required for water and sediment samples, is known to be sensitive to pyrethroid pesticides and the test organism *C. dilutus*, is known to be sensitive to neonicotinoids. A two-tiered approach is applied to assess toxicity. First, organism responses from ambient samples are compared to responses from appropriate laboratory control samples using a statistical comparison (i.e., TST). This is followed by a comparison to a “threshold value” or “Percent Effect” that indicates the magnitude of the difference in response. If the MRP threshold of 50 Percent Effect is exceeded, a follow-up sample is collected.

Sediment chemistry data for metals and PAHs are compared to TECs and PECs published by MacDonald et al. (2000). Most samples in Santa Clara County have chromium and nickel concentrations that exceed the more conservative TEC and many exceed the PEC. These metals are naturally occurring in the serpentine formations that underly mountains and hills in the region, and therefore are not prioritized for follow-up management actions. Sediment chemistry data for pyrethroid and fipronil pesticides are compared to TOC-normalized LC50s, calculated as TU equivalents.

4.1.2 WY 2024 Results

In WY 2024, SCVURPPP conducted dry weather pesticides and toxicity monitoring at two stations (Stevens Creek and San Tomas Aquino Creek).

- Statistically significant toxicity to *C. dubia* (reproduction) was observed in the San Tomas Aquino and Stevens Creek water samples. The San Tomas Aquino Creek *C. dubia* water sample’s magnitude of toxic effects exceeded the MRP threshold of 50 Percent Effect, but the threshold was not exceeded for the Stevens Creek sample. A follow-up sample was collected from San Tomas Aquino Creek for toxicity testing with *C. dubia*, which also had significant toxicity with a Percent Effect exceeding the threshold.

- Stevens Creek and San Tomas Aquino Creek sediment samples had no observed toxicity.

- Pesticide concentrations in the WY 2024 sediment samples were low, with no TOC-normalized concentrations of an individual pyrethroid found to be over 1 TU equivalent. All pesticides except for bifenthrin and cyfluthrin in San Tomas Aquino Creek were measured below levels of detection or quantification (Table 3.5). The sum of pyrethroids for both sites was also found to be below 1 TU equivalent.

- Similar to prior years, common serpentine-derived metals (chromium and nickel) were found at concentrations exceeding the TEC for both creeks. The PEC threshold was exceeded only for nickel in the Stevens Creek sediment sample. In addition, the TEC quotient for zinc was greater than 1.0 in the Stevens Creek sediment sample.

4.1.3 WY 2016 – WY 2024 Data Summary

The results of pesticides and toxicity monitoring conducted in San Tomas Aquino and Stevens Creeks during WY 2016 through WY 2024 were analyzed to identify trends.

- ***C. dilutus* toxicity.** Of the 24 dry (n=18) and wet (n=6) weather water samples, five of the dry weather samples were significantly toxic to *C. dilutus*, a test organism known to be sensitive to neonicotinoids (e.g., imidacloprid) and fipronil, but none had a Percent Effect greater than 50%. In contrast, of the 21 dry weather sediment samples, six (all from San Tomas Aquino Creek) were significantly toxic to *C. dilutus* and three of these had a Percent Effect greater than 50%.
- ***H. azteca* toxicity.** The test specimen, *H. azteca*, which is sensitive to pyrethroids has never had significant water toxicity from either creek during dry season monitoring (n=18). However, *H. azteca* had toxic effects from both creeks and Calabazas Creek during wet weather water monitoring in WY 2018. Wet weather monitoring during WY 2023 also found *H. azteca* toxicity in a sample of Guadalupe River water, but no toxic effects from Stevens Creek and San Tomas Aquino Creek were observed. Of the 18 dry weather sediment samples, two (both from San Tomas Aquino Creek) were significantly toxic to *H. azteca*, but were below the 50 Percent Effect threshold.
- ***C. dubia* toxicity.** Of the 32 dry season samples where significant toxicity has been observed,16 were water samples with *C. dubia* reproduction toxicity. All significantly toxic results generated during WY 2024 were from *C. dubia* water toxicity tests. The specimen *C. dubia* is a water flea that is sensitive to a broad range of aquatic contaminants. However, the specific cause of the chronic *C. dubia* toxicity in San Tomas Aquino Creek and Stevens Creek is unknown, and not seemingly explained by the synoptic sediment chemistry results. It is possible that the chronic *C. dubia* toxicity observed in water samples are false positives resulting from inconsistencies in laboratory QA procedures. Statewide, there have been other reports of unexplained chronic *C. dubia* toxicity. The SCCWRP recently examined this issue and recommended guidance for laboratory best practices, accreditation, and training to reduce variability and inconsistency between lab processes (Brent et al. 2023).
- **Metals and PAHs.** Between WY 2016 and WY 2024, no sediment samples in San Tomas Aquino Creek or Stevens Creek had PEC quotients greater than 1.0 for analytes other than chromium and nickel. When chromium and nickel (present in local native soils) are excluded, eight samples in the WY 2016 through WY 2024 dataset had TEC

quotients ≥ 1.0, the more conservative of the two sediment chemistry evaluation criteria. These include total PAHs from Stevens Creek in WY 2017 and WY 2018, zinc from Stevens Creek and San Tomas Aquino Creek in WY 2020, copper from Stevens Creek and San Tomas Aquino Creek in WY 2020 and 2022, copper from Stevens Creek in WY 2023, and zinc from San Tomas Aquino Creek during WY 2024.

- **Pesticides.** The most commonly detected pesticide in SCVURPPP dry weather sediment samples was bifenthrin, which was detected in 17 of the 18 samples collected from San Tomas Aquino and Stevens Creeks from WY 2016 through WY 2024. Other pesticides analyzed in sediment samples (carbaryl, fipronil and its degradates) were rarely detected. The sum-of-pyrethroids TU equivalents (calculated from TOC-normalized concentrations) ranged from 0.22 (WY 2017) to 1.7 (WY 2022) in San Tomas Aquino Creek dry weather sediment samples and 0.11 (WY 2017) to 1.3 (WY 2020) in Stevens Creek samples, with no obvious trends over the nine-year dataset.
- **Comparison to Third Party Data.** Overall, detection frequencies for bifenthrin and fipronil from the SCVURPPP dataset were similar to results from the DPR Northern California study (Ensminger 2021). Similar results were also observed with DPR wet weather *H. azteca* toxicity samples (Alvarado, 2023). The most recent results from DPR's 329 study (Alvarado and McClanahan 2024) suggest lower toxicity and pesticide detections in Northern California when compared to other regions as well as previous regional studies. Monitoring results from SWAMP SPoT also indicate some similarities with SCVURPPP data with acute *H. azteca* toxicity in the Guadalupe River. However, the most recent evidence of SPoT *H. azteca* acute toxicity is nearly a decade old (Phillips et al. 2020).

The pesticides and toxicity data collected from WY 2016 through WY 2024 provide a reference to inform management decisions regarding water quality improvement in Santa Clara County watersheds and guide the planning of future monitoring in the area.

4.2 Recommendations

The following recommendations are based on findings from nine years (WY 2016 through WY 2024) of pesticides and toxicity monitoring conducted by SCVURPPP, as well as reflections on other monitoring, data analysis, and policy development projects being conducted in the region and statewide.

- Pesticides and toxicity monitoring will continue to be conducted during the dry season at the same two stations targeted in WY 2016 through WY 2024: Stevens Creek and San Tomas Aquino Creek.
- External studies and their results will be closely followed as reports become available to compare with SCVURPPP pesticides and toxicity data. The DPR's SWPP studies are essential to understanding a long-term regional and statewide assessment of pesticide concentrations and their effects on aquatic environments. Study 329 of SWPP is particularly relevant to SCVURPPP's pesticides and toxicity program since some of their monitoring sites are located in Santa Clara County. The Program will continue to search for opportunities to share data, monitoring locations, and information with other agencies, like how WY 2023 wet weather monitoring was conducted at DPR's Guadalupe River site.

In compliance with provision C.9 of the MRP, the Program and Co-permittees are implementing pesticide toxicity control programs that focus on source control and pollution prevention measures. The control measure programs include the implementation of integrated pest management (IPM) policies/ordinances, public education and outreach programs, pesticide disposal programs, and sustainable landscaping requirements for new and redevelopment projects. As required by provision C.9.g.iii of the MRP, the Program will be submitting a Pesticide Evaluation Report with their 2025 Annual Report, which will assess progress towards implementation of the Total Maximum Daily Load (TMDL) for Diazinon and Pesticide-Related Toxicity for Urban Creeks in the region.

California's Pesticide Use Reporting Program (PUR) contains extensive data for nearly all types of registered pesticides and their associated applications. Ongoing evaluations of pesticides and their uses through PUR inform DPR, Permittees, and the public about potential emerging trends with registered pesticide usage. These efforts will eventually be supplemented by the statewide Urban Pesticides Amendments (UPAs) which will seek to improve considerations of surface water quality during the registration process overseen by state and federal pesticide regulatory authorities such as DPR and USEPA. The anticipated result of the UPAs will be reduction in pyrethroids and other pesticides in urban stormwater runoff and the eventual elimination of pesticide-related toxicity in local urban creeks. The UPAs would also likely establish a statewide monitoring program that may substitute for pesticides and toxicity monitoring requirements in MS4 permits, such as the MRP. The goal of this statewide coordinated monitoring program is to generate useful data at minimal cost and standardize information at the statewide level to support the objectives of the UPAs. At this time, the mechanism for implementing the statewide monitoring program is uncertain but will likely be developed over the next few years.

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APPENDICES

Appendix A

QA/QC Report

SCVURPPP Pesticides and Toxicity Monitoring Quality Assurance/Quality Control Report, WY 2024

1.0 Introduction

The Santa Clara Valley Urban Runoff Pollution Protection Program (SCVURPPP) conducted Pesticides and Toxicity Monitoring in Water Year (WY) 2024 to comply with Provision C.8.g (Pesticides and Toxicity Monitoring) of the National Pollutant Discharge Elimination System Program (NPDES) Municipal Regional Permit for the San Francisco Bay Area (i.e., MRP 3.0; Permit No. CAS612008, Order No. R2-2022-0018; SFBRWQCB 2022). In WY 2024, creek sediment and water monitoring included analysis for:

- Water toxicity (dry weather, MRP Provision C.8.g.i);
- Sediment toxicity (dry weather, MRP Provision C.8.g.ii); and
- Sediment chemistry (dry weather, MRP Provision C.8.g.ii).

Kinnetic Environmental, Inc. (KEI) of Santa Cruz, California collected the samples. Caltest Analytical Laboratory (Caltest) of Napa, California, and Pacific EcoRisk, Inc. of Fairfield, California performed the analyses described in Table 1.

Table 1. Pesticides and toxicity monitoring analyses conducted in WY 2024

Laboratory	Analysis	Matrix	Method Reference
Caltest	Sediment Chemistry	Sediment	EPA 6020 EPA 8270C EPA 8270 NCI EPA 9060M Plumb, 1981
Pacific EcoRisk	Toxicity	Sediment/Water	EPA/600/R-99/064 EPA-821-R-02-012 EPA-821-R-02-013

This report summarizes the Quality Assurance/Quality Control (QA/QC) procedures and results for this monitoring effort and the analyses performed by Pacific EcoRisk in the reports from September 13, 2024 and October 18, 2024. The QA/QC analysis performed by Caltest is also summarized in this QA/QC report and can be found in report Z070361 from September 10, 2024.

All sediment and water toxicity samples were originally collected by KEI on July 9, 2024 at two Santa Clara County sites (Stevens Creek – 205STE021 and San Tomas Aquino Creek – 205STQ010). There were two laboratory issues that caused the need to replace the initial water samples for two of the toxicity test organisms. The laboratory's *C. dilutus* test organisms were not viable and had to be reordered. The reorder delay resulted in the need to collect replacement water samples for this test. The *P. promelas* samples from July 9 were accidentally mislabeled in the laboratory, also resulting in the need to replace the samples. Both sets of replacement samples were collected on July 22. A pathogen-related mortality event (PRM) resulted in failed toxicity endpoints for all *P. promelas* ambient water samples collected on July 22, 2024. Follow-up testing included an increase in test replicates with fewer test species per replicate to reduce PRM interference. The *P. promelas* retest had no signs of PRM and resulted in a “pass” for all toxicity endpoints. Finally, the results of the *C. dubia* (reproduction) test from the San Tomas Aquino Creek July 9 water sample failed the test of significant toxicity (TST) with a 56 Percent Effect, resulting in the need for a follow-up sample which was collected on September 18. Samples and laboratory reports are listed in Table 2.

Table 2. Pesticides and toxicity monitoring samples analyzed in WY 2024.

<table>
<tr><th>Caltest Report Z070361 September 10, 2024</th><th>Pacific EcoRisk Report September 13, 2024</th><th>Pacific EcoRisk Report October 18, 2024</th></tr>
<tr><td rowspan="2">205STE021-S-10</td><td>205STE021-W-10</td><td rowspan="5">205STQ010-W-10b</td></tr>
<tr><td>205STE021-S-10</td></tr>
<tr><td>205STQ010-S-10</td><td rowspan="2">205STQ010-W-10</td></tr>
<tr><td rowspan="2">205STE021-S-51*</td></tr>
<tr><td>205STQ010-S-10</td></tr>
</table>

*Regional Field Duplicate

SCVURPPP utilizes the BASMAA (Bay Area Stormwater Management Agency Association) RMC (Regional Monitoring Coalition) Quality Assurance Project Plan (QAPP; BASMAA 2020) and BASMAA RMC Standard Operating Procedures (SOP; BASMAA 2016), SOP FS-13 (Standard Operating Procedures for QA/QC Data Review) as a basis for QA/QC procedures. Data were assessed for seven data quality attributes: (1) Representativeness, (2) Comparability, (3) Completeness, (4) Sensitivity, (5) Contamination, (6) Accuracy, and (7) Precision. These seven attributes are compared to Data Quality Objectives (DQOs), which were established to ensure that data collected are of adequate quality and sufficient for the intended uses. DQOs address both quantitative and qualitative assessment of the acceptability of data – representativeness and comparability are qualitative while completeness, sensitivity, precision, accuracy, and contamination are quantitative assessments. Specific DQOs are based on Measurement Quality Objectives (MQOs) for each analyte. The MQOs for each analyte are summarized in Table 3.

Overall, the results of the QA/QC review suggest that the data generated during WY 2024 pesticides and toxicity monitoring were of sufficient quality for the purposes of this program. Some of the SCVURPPP and external program sediment data were flagged for not satisfying minor MQOs and DQOs identified in the QAPP. However, none of the data were rejected. Further details regarding the QA/QC review are provided in the sections below.

Table 3. Measurement quality objectives for analytes from Appendix A of the RMC QAPP (BASMAA 2020).

Sample	Sediment					Water		
	Inorganics	Synthetic Organic Compounds (Non pyrethroids)	Pyrethroids	Conventional Analytes	Toxicity	Synthetic Organic Compounds (Non pyrethroids)	Pyrethroids	Toxicity
Laboratory Blank (Method Blank, Field Filter Blank, Equipment Rinsate Blank, Trip Blank)	<RL	<RL	<RL	80-120%	The sediment control must meet all test acceptability criteria for the species of interest. Laboratory overlying water must be of uniform quality for the species of interest (USEPA method manual 600/R-99/064)	<RL	<RL	Laboratory control water must meet all test acceptability criteria for the species of interest
Reference Material Recovery (Laboratory Control Sample)	75-125%	50-150% (70-130% if certified)	50-150%	RPD<25%	The last plotted data point (LC50 or EC50) should be within 2 standard deviations of the cumulative mean (n=20). Reference toxicant tests that fall outside of recommended control chart limits are evaluated to determine the validity of associated tests. A reference toxicant test outside of the 2 standard deviations does not invalidate the associated test results.	50-150% (70-130% if certified) 35-135% for fipronil	50-150%	The last plotted data point (LC50 or EC50) should be within 2 standard deviations of the cumulative mean (n=20). Reference toxicant tests that fall outside of recommended control chart limits are evaluated to determine the validity of associated tests. A reference toxicant test outside of the 2 standard deviations does not invalidate the associated test results.
Matrix Spike Recovery	75-125%	50-150%	50-150%	NA	NA	50-150%	50-150%	NA
Duplicates (Matrix Spike, Field, and Laboratory)	75-125%; RPD<25 %	50-150%; RPD<25% (Fipronil RPD<35% MS/MSD, <25% FD)	50-150%; RPD≤ 35% MS/MSD, <35% FD	80-120%; RPD<25%	NA	50-150%; RPD<25% (Fipronil 1-130%; RPD<35%)	50-150%; RPD≤ 35%	NA

2.0 Sediment and Water Chemistry

2.1. Representativeness

Data representativeness assesses whether the data were collected in a manner that represents actual conditions at each monitoring location. For this project, all samples were assumed to be representative if they were collected and analyzed according to protocols specified in the RMC SOPs and QAPP. Field and laboratory personnel received and reviewed the QAPP and followed prescribed protocols including laboratory methods, holding times, preservation, and storage.

The dry season sediment chemistry samples were collected by KEI on July 9, 2024 at two Santa Clara County sites. Caltest analyzed samples for inorganic compounds, synthetic organic compounds, and grain size distribution. The laboratory conducted all QA/QC requirements as specified in the RMC QAPP and reported their findings to SCVURPPP.

2.2. Hold Times

Extractions and analyses were performed within the recommended holding time criteria and no additional data flags were assigned by the QA officer.

2.3. Preservation and Sample Storage

The samples were preserved and stored appropriately as ascribed by the respective methods and no additional data flags were assigned by the QA officer.

2.4. Comparability

The QA/QC officer ensures that the data may be reasonably compared to data from other programs producing similar types of data. For pesticides and toxicity monitoring, individual stormwater programs strive to maintain comparability within the RMC. The key measure of comparability for all RMC data is the California Surface Water Ambient Monitoring Program (SWAMP) and its QAPP (SWAMP 2022).

Electronic data deliverables (EDDs) were submitted to the San Francisco Bay Regional Water Quality Control Board (SFRWQCB) in Microsoft Excel templates developed by the California Environmental Data Exchange Network (CEDEN), which are comparable to SWAMP. In addition, data entry followed SWAMP documentation specific to each data type, including the exclusion of qualitative values that do not appear on CEDEN’s look up lists[1]. Completed templates were reviewed using CEDEN’s online data checker[2] and submitted through the Environmental Data Entry and Reporting System (eDERS) from Moss Landing Marine Laboratories[3]. All WY2024 data were considered comparable to SWAMP data and other RMC data. Pesticides and toxicity monitoring data collected in WY 2024 is required to be reported to CEDEN via the CEDEN data portal[4].

2.5. Completeness

[1] Look up lists available online at https://ceden.org/CEDEN_checker/Checker/LookUpLists.php
[2] Checker available online at https://ceden.org/CEDEN_checker/Checker/
[3] https://rdc-gamma.mlml.calstate.edu:8443/security/signin?returnUrl=%2F
[4] Data available at: https://ceden.org/ceden_submitdata.shtml

Completeness is the degree to which all data were produced as planned; this covers both sample collection and analysis. An overall completeness of greater than 90% is considered acceptable for RMC chemical data and field measurements.

During WY 2024, SCVURPPP collected and analyzed 100% of the planned chemical analytes and field measurements.

2.6. Sensitivity

Sensitivity analysis determines whether the methods can identify and/or quantify results at low enough levels. This data quality attribute is evaluated via the assessment of RLs. Target Method Reporting Limits (MRLs) and actual monitoring Reporting Limits (RLs) are summarized in Table 4.

Table 4. Comparison of target and actual reporting limits (dry weight) (205STE021/205STE021-S-51/205STQ010, respectively) for sediment analytes.

Analyte	Target RL	Actual RL	Unit
Arsenic	0.3	0.3/0.31/0.31	mg/Kg
Cadmium	0.01	0.041	mg/Kg
Chromium	0.1	0.51/0.51/0.52	mg/Kg
Copper	0.01	0.2/0.2/0.21	mg/Kg
Lead	0.01	0.041	mg/Kg
Nickel	0.02	0.081/0.081/0.082	mg/Kg
Zinc	0.1	0.41/0.41/2.1 [b]	mg/Kg
PAHs (Individual)	20	18 [b]	ng/g
Bifenthrin	0.33 [a]	1 [b]	ng/g
Cyfluthrin	0.33 [a]	1 [b]	ng/g
Total Lambda-cyhalothrin	0.33 [a]	1 [b]	ng/g
Total Cypermethrin	0.33 [a]	1 [b]	ng/g
Total Deltamethrin	0.33 [a]	1 [b]	ng/g
Total Esfenvalerate/Fenvalerate	0.33 [a]	1 [b]	ng/g
Permethrin	0.33 [a]	1 [b]	ng/g
Fipronil	0.33 [a]	1 [b]	ng/g
Fipronil Desulfinyl	0.33 [a]	1 [b]	ng/g
Fipronil Sulfide	0.33 [a]	1 [b]	ng/g
Fipronil Sulfone	0.33 [a]	1 [b]	ng/g
Total Organic Carbon	0.01	0.035/0.035/0.055	% dw

[a] There are no appropriate SWAMP targets for pyrethroids or for fipronil and its degradates. For these analytes, the RMC target RLs are based on current lab capabilities.

[b] These samples were diluted, which raised the RL.

The RLs for many of the analytes in sediment samples exceeded the MRLs specified in the QAPP. All pesticide samples were diluted by a factor of 4x, which raised the RLs. However, pesticide RLs would have been under the MRL if dilution had not occurred. These pesticide concentrations were flagged with the

QA code "VDG" to demonstrate that MRLs would have been achieved if dilution had not occurred. Most pesticides were detected, but at concentrations below the RL, and thus were flagged as detected but not quantified (DNQ or J-flagged). The exceptions were bifenthrin, cyfluthrin, and permethrin in the San Tomas Aquino Creek sample. Individual PAHs were also measured from diluted samples but the actual RLs were still less than the MRL. Most PAH concentrations were unquantifiable. Some of the inorganic constituents had RLs that were above MRLs and were not from diluted samples. However, all inorganic concentrations were quantified, thus the elevated RLs did not affect the results. These samples could have been affected by high amounts of solids present, which could raise the RL and has been observed in prior years' samples. Overall, the data were deemed acceptable by the QA officer with no changes or rejections.

2.7. Contamination

For chemical data, contamination is assessed as the presence of analytical constituents in blank samples. Laboratory method blank analyses were performed at the required frequencies specified by the QAPP (a minimum of one laboratory blank must prepared and analyzed in every analytical batch). For purposes of data qualification, the laboratory method blanks were associated with all samples prepared in the analytical batch.

Zinc was detected as a quantifiable amount in one method blank sample. The result was qualified by the laboratory as "F" which means that the sample was mistakenly filtered. It is unknown whether the filtration process introduced the zinc. Chromium was also detected in a method blank but at a nonquantifiable (DNQ) amount. All other laboratory method blank results were non-detect (ND) to the method detection limits (MDLs) for all target analytes, indicating that there was no contamination present.

2.8. Accuracy

Accuracy is assessed as the percent recovery of samples spiked with a known amount of a specific chemical constituent. The analytical laboratory evaluated and reported the percent recovery of Laboratory Control Samples (LCS; in lieu of reference materials) and Matrix Spikes (MS), which were reported by the laboratory as well as recalculated by the QAO and compared to the target ranges in the QAPP. If a QA sample did not meet MQOs, all samples in that batch for that analyte were flagged.

Chromium, copper, lead, zinc, and one pesticide and two of its degradates (fipronil, fipronil desulfinyl, and fipronil sulfide) were all beyond matrix spike MQOs. Two individual PAHs (Benzo(a)pyrene and fluoranthene) were also beyond matrix spike MQOs. A fipronil degradate (fipronil sulfone) was also outside of LCS percent recovery. All other QA/QC sediment analytes' LCS and MS samples met their corresponding MQOs and frequency (one LCS and matrix spike per 20 samples or per analytical batch, whichever is more frequent per analyte), and the data were deemed acceptable by the QA officer with no changes. Some regional monitoring results external to SCVURPPP had flagged QA sample data due to minor inconsistencies relative to MQOs. However, no data were rejected.

2.9. Precision

Precision is the repeatability of a measurement and is quantified by the Relative Percent Difference (RPD) of two duplicate samples. Three measures of precision were used for this project, laboratory duplicates (LCSDs), matrix spike duplicates (MSDs), and field duplicates (FDs). The MQO for RPDs specified by the QAPP is <25% for most analytes and <35% for pyrethroids in a field duplicate and ≤35% for pyrethroids in spiked duplicates. Fipronil has RPD MQOs of <35% for spiked duplicates and <25% for field duplicates if both samples are above the RL (see Table 3).

The LCSD for grain size analysis of small and medium pebbles was beyond the MQO. A MSD for lead was found to be equal to 25 RPD. Results above MQOs were flagged, even if batch QA data were from external projects. All other sediment LCSD and MSD samples met their corresponding MQO RPDs when compared with their paired LCS and MS samples as well as frequency (one LCSD and MSD per 20 samples or per analytical batch, whichever is more frequent). In WY 2024, the regional field duplicate was collected by SCVURPPP on behalf of the RMC. The field duplicate was collected at the same time as the Stevens Creek sample. All RPDs had to be calculated from quantifiable concentrations (i.e., detected). The analysis of precision for the sediment field duplicate sample revealed a total of four analytes with RPDs over the MQO (benz(a)anthracene, chrysene, fluoranthene, phenanthrene, and pyrene). Qualifying data exceeding MQOs were flagged. This list is comparable to past years' results.

The sediment field duplicate sample and corresponding RPDs were analyzed for precision and values are shown in Table 6. Due to the variability in reporting limits, values less than the RL (J-flagged, DNQ) should not be evaluated for RPD. The measured concentrations of many of the analytes from the original and duplicate samples were below the method detection limit and therefore reported as ND.

Table 6. Summary of SCVURPPP sediment sample data qualifiers assigned as a result of field duplicates exceeding (highlighted) the measurement quality objective for relative percent difference.

<table>
<tr><th colspan="2">Analyte</th><th>Unit</th><th>Original</th><th>Duplicate</th><th>RPD (%)</th><th>Exceeds MQO? (<25%)[a]</th></tr>
<tr><td rowspan="12">Grain Size Distribution</td><td>Clay: <0.0039 mm</td><td>%</td><td>5.3</td><td>5.7</td><td>7</td><td rowspan="22">No</td></tr>
<tr><td>Silt: 0.0039 to <0.0625 mm</td><td>%</td><td>4.5</td><td>4.9</td><td>9</td></tr>
<tr><td>Sand: V. Fine 0.0625 to <0.125 mm</td><td>%</td><td>7.8</td><td>8.5</td><td>9</td></tr>
<tr><td>Sand: Fine 0.125 to <0.25 mm</td><td>%</td><td>24.6</td><td>23.8</td><td>3</td></tr>
<tr><td>Sand: Medium 0.25 to <0.5 mm</td><td>%</td><td>39.3</td><td>40.3</td><td>3</td></tr>
<tr><td>Sand: Coarse 0.5 to <1.0 mm</td><td>%</td><td>14</td><td>12.7</td><td>10</td></tr>
<tr><td>Sand: V. Coarse 1.0 to <2.0 mm</td><td>%</td><td>4.5</td><td>4.2</td><td>7</td></tr>
<tr><td>Granule: 2.0 to <4.0 mm</td><td>%</td><td>1.9</td><td>1.6</td><td>17</td></tr>
<tr><td>Pebble: Small 4 to <8 mm</td><td>%</td><td>0.5</td><td rowspan="4">ND</td><td rowspan="4">NA</td></tr>
<tr><td>Pebble: Medium 8 to <16 mm</td><td rowspan="3">%</td><td rowspan="3">ND</td></tr>
<tr><td>Pebble: Large 16 to <32 mm</td></tr>
<tr><td>Pebble: V. Large 32 to <64 mm</td></tr>
<tr><td rowspan="7">Metals</td><td>Arsenic</td><td>mg/Kg dw</td><td>2.6</td><td>2.7</td><td>4</td></tr>
<tr><td>Cadmium</td><td>mg/Kg dw</td><td>0.21</td><td>0.21</td><td>0</td></tr>
<tr><td>Chromium</td><td>mg/Kg dw</td><td>70</td><td>73</td><td>4</td></tr>
<tr><td>Copper</td><td>mg/Kg dw</td><td>26</td><td>27</td><td>4</td></tr>
<tr><td>Lead</td><td>mg/Kg dw</td><td>9.6</td><td>10</td><td>4</td></tr>
<tr><td>Nickel</td><td>mg/Kg dw</td><td>59</td><td>61</td><td>3</td></tr>
<tr><td>Zinc</td><td>mg/Kg dw</td><td>71</td><td>72</td><td>1</td></tr>
<tr><td>TOC</td><td>Total Organic Carbon</td><td>% dw</td><td>0.37</td><td>0.39</td><td>5</td></tr>
<tr><td rowspan="2">Pyrethroids (MQO<35%)</td><td>Bifenthrin</td><td>ng/g dw</td><td>0.81J</td><td>0.51J</td><td rowspan="2">NA</td></tr>
<tr><td>Cyfluthrin</td><td>ng/g dw</td><td>0.12J</td><td>0.13J</td></tr>
</table>

Analyte		Unit	Original	Duplicate	RPD (%)	Exceeds MQO? (<25%)[a]
	Lambda-Cyhalothrin	ng/g dw	ND	ND		
	Cypermethrin	ng/g dw	0.16J	0.15J		
	Deltamethrin/Tralomethrin	ng/g dw	ND			
	Esfenvalerate/Fenvalerate	ng/g dw				
	Permethrin, Total	ng/g dw				
Fipronil	Fipronil	ng/g dw				
	Fipronil Desulfinyl	ng/g dw				
	Fipronil Sulfide	ng/g dw				
	Fipronil Sulfone	ng/g dw				
Polycyclic Aromatic Hydrocarbons	Acenaphthene	ng/g dw				
	Acenaphthylene	ng/g dw				
	Anthracene	ng/g dw				
	Benz(a)anthracene	ng/g dw	16J	27		
	Benzo(a)pyrene	ng/g dw	ND			
	Benzo(b)fluoranthene	ng/g dw				
	Benzo(e)pyrene	ng/g dw				
	Benzo(g,h,i)perylene	ng/g dw				
	Benzo(k)fluoranthene	ng/g dw				
	Biphenyl	ng/g dw				
	Chrysene	ng/g dw	34	48	34	**Yes**
	Dibenz(a,h)anthracene	ng/g dw	ND		NA	No
	Dibenzothiophene	ng/g dw				
	Dimethylnaphthalene, 2,6-	ng/g dw				
	Fluoranthene	ng/g dw	46	69	40	**Yes**
	Fluorene	ng/g dw	ND		NA	No
	Indeno(1,2,3-c,d)pyrene	ng/g dw				
	Methylnaphthalene, 1-	ng/g dw				
	Methylnaphthalene, 2-	ng/g dw				
	Methylphenanthrene, 1-	ng/g dw				
	Naphthalene	ng/g dw				
	Perylene	ng/g dw				
	Phenanthrene	ng/g dw	21	30	35	**Yes**
	Pyrene	ng/g dw	44	69	44	
	Trimethylnaphthalene, 2,3,5-	ng/g dw	ND		NA	No

a. MQO for precision of J-flagged data does not apply

3.0 Toxicity Testing

3.1. Representativeness

Data representativeness assesses whether the data were collected in a manner that represents actual conditions at each monitoring location. For this project, all samples were assumed to be representative if they were collected and analyzed according to protocols specified in the RMC SOPs QAPP. Field and laboratory personnel received and reviewed the QAPP and followed prescribed protocols including laboratory methods, holding times, preservation, and storage.

Dry weather water and sediment toxicity samples were collected by KEI concurrently with dry season sediment chemistry samples at two Santa Clara County sites on July 9, July 22, and September 18, 2024. All toxicity tests were performed by Pacific EcoRisk. In accordance with the MRP, the water samples were analyzed for toxicity to five organisms (*Selenastrum capricornutum*, *Ceriodaphnia dubia*, *Pimephales promelas*, *Hyalella azteca*, and *Chironomus dilutus*) and the sediment samples were analyzed for toxicity to *Hyalella azteca* and *Chironomus dilutus*. Nearly all organisms were tested in ambient water from July 9, 2024. Testing for *P. promelas* and *C. dilutus* toxicity endpoints occurred with July 22, 2024 ambient water samples due to previously poor *C. dilutus* specimen quality and an analyst's mistake with *P. promelas* samples. There was also a correction on a statistical analysis sheet associated with the previous sample. A PRM event was observed for *P. promelas* in the ambient water sample collected on July 22; therefor the PRM testing protocol was initiated to minimize the infections and allow both toxicity endpoints to be accurately analyzed. The test specimen, *C. dubia* failed the chronic endpoint toxicity test with July 9 San Tomas Aquino Creek sample water. The percent effect was 56, which mandates follow-up testing to be completed. Follow-up testing was completed at San Tomas Aquino Creek on September 18, 2024 for *C. dubia* reproduction. The result of the retest was a "fail" with a 58 percent effect. None of the data were rejected. Further details regarding the QA/QC review are provided in the sections below.

3.2. Hold Times

Exposures and analyses were performed within the recommended holding time criteria and no additional data flags were assigned by the QA officer.

3.3. Preservation and Sample Storage

The samples were preserved and stored appropriately as ascribed by the respective methods and no additional data flags were assigned by the QA officer.

3.4. Comparability

The QA/QC officer ensures that the data may be reasonably compared to data from other programs producing similar types of data. For pesticides and toxicity monitoring, individual stormwater programs strive to maintain comparability within the RMC. The key measure of comparability for all RMC data is the SWAMP.

Electronic data deliverables (EDDs) were submitted to the San Francisco Bay Regional Water Quality Control Board (SFRWQCB) in Microsoft Excel templates developed by the California Environmental Data Exchange Network (CEDEN) which are comparable to SWAMP. In addition, data entry followed SWAMP documentation specific to each data type, including the exclusion of qualitative values that do not appear on CEDEN's look up lists. Completed templates were reviewed using CEDEN's online data checker[5] and

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[5] Checker available online at https://ceden.org/CEDEN_checker/Checker/

submitted through eDERS from Moss Landing Marine Laboratories[6]. Pesticides and toxicity monitoring data collected in WY 2024 is required to be reported to CEDEN via the CEDEN data portal.

All WY 2024 data were considered comparable to SWAMP data and other RMC data.

3.5. Completeness

Completeness is the degree to which all data were produced as planned; this covers both sample collection and analysis. An overall completeness of greater than 90% is considered acceptable for RMC chemical data and field measurements.

The MRP requires the collection of dry weather water and sediment toxicity samples at two sites per year in Santa Clara County. Pacific EcoRisk tested the required organisms for toxicity, and 100% of results were reported. During WY 2024, SCVURPPP collected and analyzed 100% of the planned toxicity analytes and field measurements.

3.6. Sensitivity and Accuracy

Internal laboratory procedures that align with the RMC QAPP were performed and submitted to SCVURPPP. Four measures of quality control are assessed, including maintenance of acceptable test conditions, negative control testing, positive control (i.e., reference toxicant testing), and Concentration Response Relationship assessment. The laboratory data QC checks found that all conditions and responses were acceptable. A copy of the laboratory QC reports are available upon request (Pacific EcoRisk September 13, 2024 and October 18, 2024)

3.7. Contamination

There are no QA/QC procedures for contamination of toxicity samples other than applicable RMC SOPs to limit possible contamination of samples. The test species, *P. promelas* was affected by PRM in both July 22 samples; the control water had no observed mortality. There were no water quality issues (e.g., dissolved oxygen, pH, and conductivity) in the affected replicates. Laboratory staff followed PRM testing protocol, which successfully analyzed the tests with minimal interference from the contamination. Although increased replicate testing was initiated as described in the PRM protocol, the laboratory did not provide photos of the affected replicates because of missing protocol instructions.

3.8. Precision

Field duplicates for water and sediment toxicity are not required by the RMC QAPP. Subsequently, precision was not evaluated.

[6] https://rdc-gamma.mlml.calstate.edu:8443/security/signin?returnUrl=%2F

4.0 References

BASMAA (Bay Area Stormwater Management Agency Association) Regional Monitoring Coalition (RMC). 2016. Creek Status and Pesticides & Toxicity Monitoring Standard Operating Procedures, Final Version 3. Prepared for BASMAA by EOA, Inc. on behalf of the Santa Clara Urban Runoff Pollution Prevention Program and the San Mateo Countywide Water Pollution Prevention Program, Applied Marine Sciences on behalf of the Alameda Countywide Clean Water Program, and Armand Ruby Consulting on behalf of the Contra Costa Clean Water Program. 190 pp.

BASMAA (Bay Area Stormwater Management Agency Association) Regional Monitoring Coalition (RMC). 2020. Creek Status and Pesticides & Toxicity Monitoring Quality Assurance Project Plan, Final Version 4. Prepared for BASMAA by EOA, Inc. on behalf of the Santa Clara Urban Runoff Pollution Prevention Program and the San Mateo Countywide Water Pollution Prevention Program, Applied Marine Sciences on behalf of the Alameda Countywide Clean Water Program, and Armand Ruby Consulting on behalf of the Contra Costa Clean Water Program. 79 pp plus appendices.

SFBRWQCB (San Francisco Bay Regional Water Quality Control Board). 2022. Municipal Regional Stormwater NPDES Permit. Order R2-2022-0018, NPDES Permit No. CAS612008. May. 724 pp.

Surface Water Ambient Monitoring Program (SWAMP). 2022. Surface Water Ambient Monitoring Program Quality Assurance Program Plan. Version 2.0. January. 152 pp.