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STUDY 329: Surface Water Monitoring for Pesticides in Urban Areas of Northern California (Water Year 2025/2026)

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1.0 INTRODUCTION

Pesticides are commonly applied in urban areas. Over 5 million pounds of pesticides were reported for structural and landscape applications in 2023 in the California Department of Pesticide Regulation (DPR) Pesticide Use Reporting Database (PUR) (DPR, 2025). The actual amount of pesticides applied in urban areas is likely higher, as non-professional use is not reported in PUR. With this substantial urban load, there is high potential for pesticide runoff into urban creeks and rivers.

Monitoring studies have frequently detected pesticides in urban surface waters. Toxicity testing has revealed that urban-use pesticides have the potential to adversely affect aquatic invertebrate organisms in urban surface waters (Budd et al, 2020; Holmes et al., 2008; Lao et al., 2010; Weston and Jackson, 2009; Weston and Lydy, 2014). Other studies have associated potential toxicity based on exceedances of the United States Environmental Protection Agency's (USEPA) aquatic benchmarks (Budd et al., 2015; Ensminger et al., 2013, Gan et al., 2012, Batikian et al., 2019). Label changes or regulations have been enacted to mitigate the effects of specific pesticides where toxicity was a concern (DPR, 2020b; UC ANR, 2019, USEPA, 2017a, b, c).

To determine pesticide exposures in urban runoff and surface waters, DPR's Surface Water Protection Program (SWPP) began monitoring California's urban areas in 2007; the study became a statewide monitoring program in 2008 (He, 2008; Kelley, 2007). This program helped define pesticide runoff patterns from urban neighborhoods and watersheds (Budd et al, 2020; Budd et al., 2015; Ensminger et al., 2013). Continued high use of pesticides in urban areas, frequent detections in surface water, and implementation of mitigation actions warrant continued monitoring of the state's urban waterways. Study 329 continues its urban monitoring in Northern California from Water Year (WY) 2024/2025. This study will continue to evaluate sources of pesticide runoff, monitor larger urban watersheds, and evaluate toxicity at selected sites. Resulting data from this protocol will be used in future assessments of trends in pesticide concentrations.

2.0 OBJECTIVES

For Study 329 (WY 2025/2026), Northern California urban monitoring, the objectives are:

1) Identify the presence and concentrations of pesticide contamination in urban runoff and waterways;
2) Evaluate the magnitude of measured concentrations relative to water quality or aquatic toxicity thresholds;
3) Evaluate pesticide concentration trends through long-term monitoring;
4) At selected monitoring sites, determine the toxicity of water samples in laboratory toxicity tests conducted with *Hyalella azteca*, *Chironomus dilutes,* or *Ceriodaphnia dubia*;
5) Evaluate the effectiveness of implemented mitigation measures such as surface water regulations and label changes through long-term (multi-year) monitoring;
6) Monitor deposition of sediment-bound pyrethroids within selected watersheds;
7) Evaluate sources of pesticide loading through land use comparisons;
8) Determine the effectiveness of a structural Best Management Practices (BMP, i.e., carbon sock) removal of pesticide residues from runoff;
9) Evaluate effect of filtering samples on pyrethroid concentrations and *Hyalella azteca* toxicity.

3.0 PERSONNEL

The study will be conducted by staff from the DPR's Environmental Monitoring Branch, Surface Water Protection Program, under the general direction of Anson Main, Ph.D., Environmental Program Manager I. Key personnel are listed below:

- Project Lead: Kari McClanahan
- Field Coordinator: John Wheeler
- Reviewing Scientist: Robert Budd, Ph.D.
- Statistician: Xuyang Zhang, Ph.D.
- Laboratory Liaison: Joshua Alvarado
- Analytical Chemistry: Center for Analytical Chemistry, California Department of Food and Agriculture (CDFA)
- Toxicity Tests: University of California at Davis, Aquatic Health Program

Please direct questions regarding this study to Kari McClanahan, Environmental Scientist, at Kari.McClanahan@cdpr.ca.gov.

4.0 STUDY PLAN

4.1 Site Selection.

The Surface Water Monitoring Prioritization (SWMP) model is used to identify priority areas for monitoring (Luo et al., 2017). The SWMP model incorporates pesticide use, aquatic toxicity, and population density data at the Hydrological Unit Code 12 (HUC; USGS, 2013) watershed level to rank areas for monitoring by aggregating HUC12s into larger HUC8 watersheds. For this study, HUC12s were considered if they were contained in the eight Northern California HUC4s as defined in Luo et al. (2017) and in the top eight HUC8s by SWMP based on final pesticide priority score of ≥ 9 for urban pesticide use (structural pest control and landscape maintenance). Using a ranking of ≥ 9 allows for selecting monitoring areas that have a higher potential for adverse risk to more sensitive aquatic organisms. Final HUC12 selection is then based on historical monitoring, fulfilling study objectives, site access and safety, budget constraints, exclusion of agricultural inputs, and spatial distribution between top ranked HUC12s selected by the model. The Sacramento and San Francisco Bay areas are the two main areas of Northern California where the highest levels of pesticide concentrations and detections are expected in urban runoff. Of the top eight ranked HUC8s, three are in the Sacramento area, four are in the San Francisco Bay area, and one is in the San Joaquin Delta (Appendix 1).

Surface water monitoring programs generally monitor within urban creeks or rivers and at storm drain outfalls. Because of lower dilution effects and proximity to the source of pesticide applications compared to waterbodies, storm drain outfalls tend to have higher pesticide detections and concentrations. Information from storm drain outfalls allows for a more direct measure of land use contributions (e.g., residential, commercial, industrial, and other non-residential areas).

4.1.1 Sacramento Area.

The Sacramento area ranks higher than the San Francisco Bay area in the SWMP, with the three top ranked HUC8s (Appendix 1), even given the much larger population in the San Francisco Bay area (California Department of Finance: Demographics, 2020). Monitoring will occur at established sites within the two top ranked HUC8s at two HUC12 watersheds: Pleasant Grove Creek, and Arcade Creek (Figure 1). The Arcade Creek site is near the United States Geological Survey (USGS) gage station 11447360. Sampling sites at or near USGS gage stations allow for a Quality Control check on the percentage of the storm runoff that was collected. This can be used to estimate mass loading by comparing the sampling duration with the periods of elevated water level.

For WY 2025/2026, the Northern California Urban Monitoring Program will monitor three established storm drain outfall sites, two in the Pleasant Grove Creek Watershed and one in the Lower American Watershed (Appendix 2; Figure 1). These sites have been monitored for at least fourteen years and are considered long-term monitoring sites, used for trend analysis. Although the Lower American Watershed (site FOL2) does not rank in the top three HUC12s for monitoring in SWMP as described in the criteria for HUC12 selection, it will continue to be monitored due to previous pesticide monitoring detections and its value as a long-term site. Carbon sock structural BMPs will be deployed at two sites (FOL2 and PGC022) during the dry season. Effectiveness of BMP treatment will be determined by comparing pesticide concentrations upstream and downstream of carbon socks. In addition, water samples from select sites with moderate toxicity will be collected and mechanically filtered to remove particle-bound contaminants prior to chemical and toxicological analyses and compared with unfiltered samples. This will help determine the contribution of particle-bound pesticides on both pesticide concentration and aquatic toxicity.

4.1.2 San Francisco Bay Area.

In the San Francisco Bay area, monitoring will continue at established sites on mainstem creeks and rivers in three top ranked HUC8s (Appendix 2; Figure 2). The San Lorenzo and Guadalupe sites are at or near USGS gage stations, which allows SWPP staff to calculate the percentage of the storm runoff sampled.

4.1.3 Exploratory Sites.

During WY 2025/2026, monitoring may include water samples from sites intended to broaden spatial distribution, investigate runoff from other sources, or collaborate with other monitoring studies. Focus will be placed on exploring storm drains in the San Francisco Bay area and on adding storm drains from multi-family housing and industrial sources, which are currently lacking in this study, as most storm drains are located in areas with single family homes.

4.2 Selection of Pesticides.

For ambient monitoring, the SWMP model was used to assist in pesticide selection. Based on current use patterns, aquatic toxicity benchmarks, and physicochemical properties, the SWMP output is presented as a relative prioritization (final) score (Budd et al., 2013; Luo, 2015). The final score provides a guideline for monitoring. However, the decision to monitor a specific pesticide is influenced by other factors, including previous monitoring data, budgetary constraints, pesticide use patterns, and current analytical capabilities.

For this study, pesticides that received a final score of nine or higher in the SWMP model for urban use (structural pest control and landscape maintenance) were considered for monitoring unless: 1) they received a "false" recommendation in the SWMP model, based on the pesticides physicochemical properties such as half-life and solubility, which make them unlikely to cause surface water toxicity; 2) there is no analytical method currently available; 3) previous monitoring results had few detections, or 4) their use pattern is not likely to run off into surface water.

Pesticides with a score of less than 9 will not be monitored unless they are included in the same analytical screen as higher ranking pesticides.

The Sacramento (Placer and Sacramento counties) and San Francisco Bay (Alameda, Contra Costa, and Santa Clara counties) were modeled separately in SWMP as two distinct geographical areas. In Sacramento, the SWMP model selected 27 pesticides for monitoring with a final score $\geq$9. Currently, CDFA has analytical methods for 22 of these pesticides (Appendices 3 and 5). In the San Francisco Bay area, the SWMP model selected 24 pesticides, 21 of which were also selected in the Sacramento area; CDFA has methods for 21 of the pesticides (Appendices 4 and 5). In addition to the analytes included in the present analytical suites, the SWMP identified six analytes in need of analytical method development: Alpha-cypermethrin, Dithiopyr, Novaluron, Prallethrin, PCNB, and Sulfometuron-methyl.

4.3 Water Sampling.

Water samples will be collected four times a year: during two rain events and two dry-season events, according to Deng and Ensminger (2021) (Table 1). SWPP will attempt to collect storm samples during the first major storm event of WY 25-26 and during another major storm in the winter of 2026. Dry-season sampling will occur in June and August 2026. The first storm will be collected in the fall (October-December), with priority to the "first flush" storm after the long dry season, regardless of month. The second storm will be collected later in the winter (January–February), with the intent of 'bracketing' early and late season storm runoff conditions. Water samples from exploratory sites may be monitored during any dry or storm event. During dry- season monitoring, water samples will be collected as grab samples directly into 1-L amber bottles (Bennett, 1997). Where the stream is too shallow to collect water directly into these bottles, a stainless-steel container will be used to initially collect the water samples. During storm events, samples will usually be collected with Teledyne ISCO automatic 6700 series samplers unless resources are lacking; in these cases, grab samples may be substituted. For ISCO samplers, time-weighted aliquots of the entire storm sample will be collected as a composite sample (Jones, 2000). Samples will be transported on wet ice and then refrigerated at 4°C until analyzed.

4.4 Sediment Sampling.

Sediments will be collected at select sites twice a year during the dry season with stainless steel scoops from the top bed layer (Mamola, 2005) (Table 1). All sediments will be sifted through a 2-mm sieve to remove gravel and plant material and analyzed for pyrethroids and total organic carbon (TOC).

4.5 Toxicity.

Water samples will be collected from a subset of the sampling sites during the dry and storm seasons (Table 2) and sent to the University of California, Davis, Aquatic Health Program to be tested for toxicity to *H. azteca* and *C. dilutus* or *C. dubia*.

4.6 Field Measurements.

Water physicochemical properties (dissolved oxygen, electrical conductivity, pH, salinity, temperature, and total dissolved solids) will be measured *in situ* during all sampling events with a calibrated Aqua TROLL 400 multiparameter probe, following the standard operating procedures for the multiparameter sonde (Mecredy, 2024). Flow data at or near sites at USGS gaging stations (Arcade Creek, Guadalupe River, and San Lorenzo Creek) will be utilized to estimate the percentage of the storm that was sampled (USGS, 2020).

4.7 Sample Transport.

SWPP staff will transport samples following the procedures outlined in DPR Standard Operating Procedure (SOP) QAQC004.01 (Jones, 1999). A chain-of-custody record will be completed and accompany each sample.

4.8 Modifications for WY 2025/2026.

The current sampling plan is an extension of urban monitoring in Northern California (previous sampling protocols, including Studies 269, 299, and 329 can be found on the Environmental Monitoring Protocols webpage). The sampling and analysis schedule are similar to WY 2024/2025 with a few sites removed to allow for more exploratory sampling (Table 3).

5.0 LABORATORY ANALYSES

5.1. Chemical Analysis.

CDFA will conduct pesticide analysis for water and sediment samples. They will analyze up to 86 different pesticides and degradates in seven different analytical screens (Appendices 5 and 6). All laboratory Quality Assurance/Quality Control will follow DPR guidelines and will consist of laboratory blanks, matrix spikes, matrix spike duplicates, surrogate spikes, and blind spikes (Peoples, 2019). Laboratory blanks and matrix spikes will be included in each extraction set.5.2 Organic Carbon and Suspended Sediment Analysis.

SWPP staff will analyze water samples for TOC and dissolved organic carbon (DOC) using a Vario TOC Cube TOC/TNb Analyzer (Elementar Analysensysteme GmbH, Langenselbold, Germany) based on previously outlined methods (Goh, 2011; Ensminger, 2013a). Water samples will also be analyzed for suspended sediment (Goh, 2010; Ensminger, 2013b). Sediment samples will be analyzed for TOC (Goodell, 2016).

6.0 DATA ANALYSIS

All data generated by this project will be entered into a Microsoft® Office Access database that holds site information, field measurements, and laboratory data since the state-wide project was initiated in 2008. All ambient monitoring analytical data will also be uploaded into the publicly available DPR Surface Water Database (SURF) (CDPR, 2018c). Toxicity and water quality data are not accessible via SURF; however, they are available upon request. An annual report will be written to summarize detections, exceedances of aquatic life toxicity benchmarks (USEPA, 2025), and potential sediment toxicity; upon completion the report will be available at DPR Environmental Monitoring's Study Report web page. In the annual report, recommendations will be made for any follow-up or detailed data analysis for pesticides that consistently exceeded benchmarks.

7.0 TIMETABLE

Field Sampling:	October 2025 – August 2026
Chemical Analysis:	October 2025 – December 2026
Summary Report:	January – March 2027
SURF Data Upload:	March – May 2027

8.0 LABORATORY BUDGET

SWPP requests that CDFA analyze 292 water samples and 12 sediment samples over a minimum five monitoring events for Study 329, WY 2025/2026 (Table 1).

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Table 1. Planned water and sediment monitoring for WY 2025/2026. For monitoring site information, see Appendix 2. For chemical screen information, see Appendices 5 and 6.

Site	Analytical Screen*	First Storm 2025	Second Storm 2026	First Dry 2026	Second Dry 2026	Exploratory Events	Total Samples
ARC_ARC	DN, LC, PYW, PX, NEO, GLY	6	6	6	6	0	24
FOL2	DN, LC, PYS, PYW, PX, NEO, GLY	6	6	7	7	0	26
PGC010	DN, LC, PYS, PYW, PX, NEO, GLY	6	6	7	7	0	26
PGC019/022	DN, LC, PYS, PYW, PX, NEO, GLY	6	6	7	7	0	26
PGC058	DN, LC, PYW, PX, NEO, GLY	6	6	6	6	0	24
GUA_TRM	DN, LC, PYS, PYW, PX, NEO, GLY	6	6	7	7	0	26
SLC_LA	DN, LC, PYW, PX, NEO, GLY	6	6	6	6	0	24
WAL_CA	DN, LC, PYS, PYW, PX, NEO, GLY	6	6	7	7	0	26
Exploratory (up to 6 sites)	LC, PYW, PX**	0-18	0-18	0-18	0-18	72	72
QC (Dup)	DN, LC, PYS, PYW, PX, NEO	5	5	6	6	0	22
QC (FMS/FMSD)	PYW	2	2	2	2	0	8
Total	DN, LC, PYS, PYW, PX, GLY	55	55	61	61	72	304

* **DN**, dinitroaniline herbicides, oxyfluorfen, and chlorfenapyr; **LC**, liquid chromatography multi-analyte; **PY**, pyrethroid (water and sediment); **PX**, phenoxy/synthetic auxin herbicides; NEO, neonicotinoids; GLY, Glyphosate, Glufosinate and Aminomethylphosphonic Acid (AMPA).
** Additional screens may be added to exploratory sites after initial evaluation.

Table 2. Toxicity sampling schedule

Sites	First Storm	Second Storm	First Dry	Second Dry
PGC010, PGC022, FOL002, ARC_ARC, SLC_LA, GUA_TRM,	*Hyalella azteca:* 6 samples *Ceriodaphnia dubia/ Chironomus: 3* samples	*Hyalella azteca: 6* Samples *Ceriodaphnia dubia/ Chironomus: 3* samples	*Hyalella azteca: 7* samples, including one filtered water *Ceriodaphnia dubia/ Chironomus:* 6 samples	*Hyalella azteca: 7* samples, including one filtered water *Ceriodaphnia dubia/ Chironomus: 6* samples
PGC022_BMP, FOL002_BMP	*NA*	*NA*	*Hyalella azteca:* 2 samples	*Hyalella azteca:* 2 samples

Table 3. Modifications from sampling plan for water year 2025-2026

Change from WY 24-25	**Justification**
Removal of MIN_MR in Roseville from core sampling plan	Although this site is in a top ranked HUC12 according to the SWMP model, previous sampling has led to few detections. Dropping it from the core sites and visiting periodically will allow resources to be allocated to expanding the monitoring locations.
Removal of SRC_JD in Pleasanton from the sampling plan	This site is located in the same HUC8 as SLC_LA, which has had similar results in previous monitoring. Removing it from the plan will allow resources to be allocated to expanding the monitoring locations.
Removal of SLV_KNG in San Jose from the sampling plan	This site is located in the same HUC8 as GUA_TRM, which has had similar results in previous monitoring. Removing it from the plan will allow resources to be allocated to expanding the monitoring locations.
Addition of exploratory sites, such as storm drains in the Bay Area and from sources such as multi-family homes and industrial areas.	This will allow for broader spatial distribution and a better understanding of contribution from various land use sources (ie. residential, commercial).

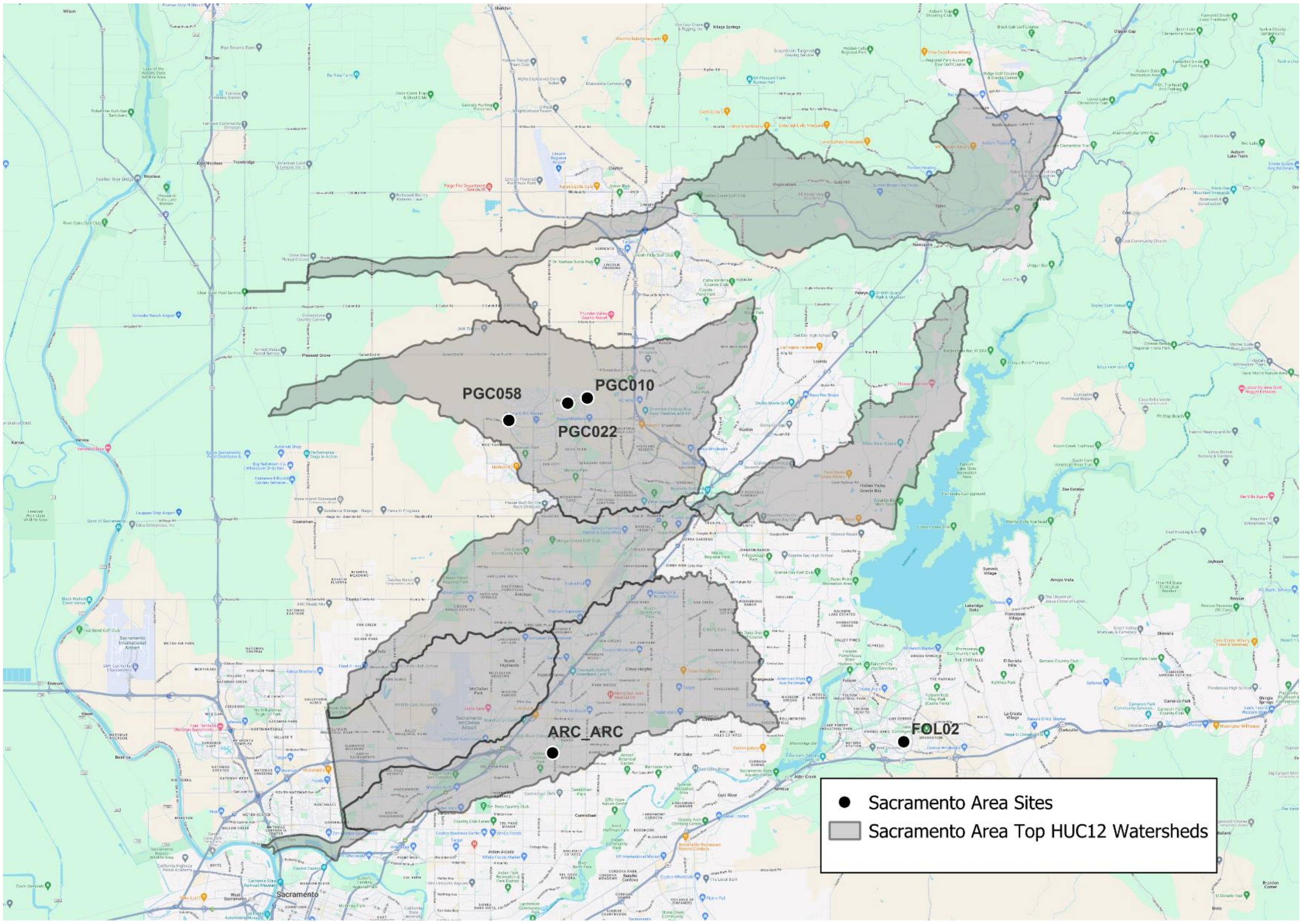

Figure 1. Sacramento area monitoring sites (black dots) and top HUC12 watersheds for WY 2025/2026.

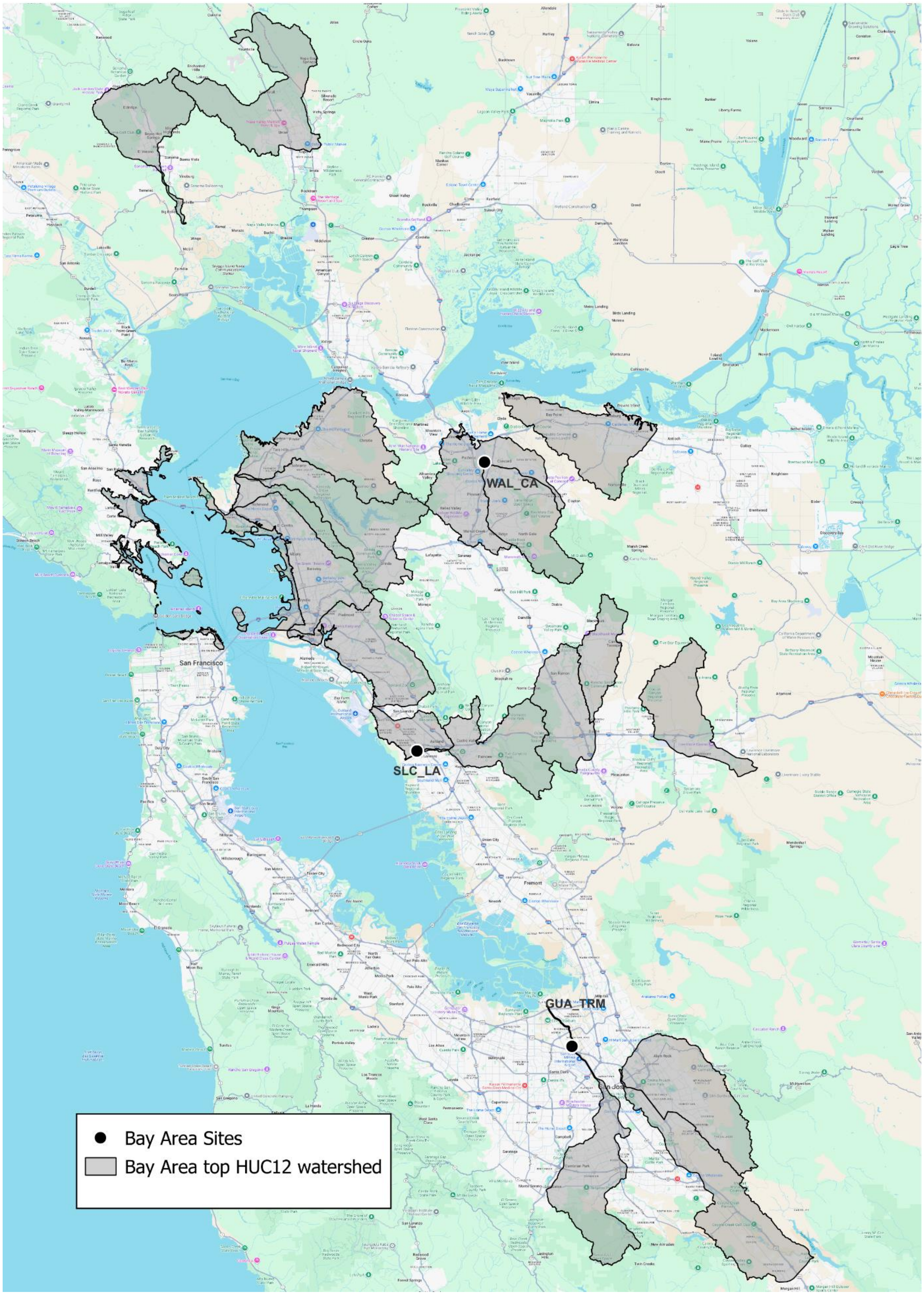

Figure 2. San Francisco Bay area monitoring sites and top HUC12 watersheds for WY 2025/2026.

Appendix 1. Top eight HUC8's identified for urban monitoring in Northern California, ordered by the ranking process.

HUC8 Code	HUC8 Name	DPR Monitoring Location
18020111	Lower American	ARC_ARC
18020161	Upper Coon-Upper Auburn	PGC010, PGC022, PGC058
18020163	Lower Sacramento	(Exploratory Site)
18050002	San Pablo Bay	(Exploratory Site)
18050001	Suisun Bay	WAL_CA
18050004	San Francisco Bay	SLC_LA
18040003	San Joaquin Delta	(Exploratory Site)
18050003	Coyote	GUA_TRM

SWMP Model Parameters: Use pattern: Urban; PUR Data 2021-2023; Toxicity Data (acute and chronic): USEPA Aquatic Life Benchmarks/Supplemented by Benchmark Equivalent; Max. number of top pesticides for reporting: 100;
SWMP AOI/POI Determination: Study Domain by HUC4: 8 Northern HUC4s; POI Selection: All AI with final score ≥ 9 (39 AI selected); HUC8 Analysis: All (105 HUC8s selected); HUC12 Analysis: 3 HUC12s per selected HUC8;

Appendix 2. Sampling site details for WY 2025/2026. For site type, SD = storm drain outfall; MS = mainstem creek or river. PGC022 sediment sampling will be downstream of the union of PGC021 and PGC022 (reported as PGC019). If there is no measurable runoff at PGC058, water will be collected at PGC040 (38.79857, -121.34802) to be consistent with previous years.

Site Code	Site Type	Sample Type	Description	City	HUC12/Name	Latitude GPS Coordinates (NAD83)	Longitude GPS Coordinates (NAD83)
PGC010	SD	Water Sediment	Outfall at Diamond Woods Circle	Roseville	180201610302 Pleasant Grove Creek	38.80477	-121.32733
PGC022	SD	Water	Outfall at Opal and Northpark Drive	Roseville	180201610302 Pleasant Grove Creek	38.802599	-121.338787
PGC019	SD	Sediment	Combination of outfalls at Opal and Northpark Drive (this site may also substitute for PGC022 if limited runoff)	Roseville	180201610302 Pleasant Grove Creek	38.80248	-121.3386
PGC058	MS	Water	near Hayden Pkwy and Blue Oaks Blvd	Roseville	180201610302 Pleasant Grove Creek	38.79477	-121.37251
ARC_ARC	MS	Water	Arcade Creek at American River College	Sacramento	180201110302 Arcade Creek	38.645293	-121.347359
FOL2	SD	Water Sediment	Outfall at Brock Circle	Folsom	180201110201 Upper American River (Alder Creek)	38.6503	-121.14494
WAL_CA	MS	Water Sediment	Walnut Creek near Concord Avenue	Concord	180500010204 Walnut Creek	37.980630	-122.0516
SLC_LA	MS	Water	San Lorenzo Creek at Lorenzo Avenue	San Leandro	180500040802 San Lorenzo	37.684572	-122.139337
GUA_TRM	MS	Water Sediment	Guadalupe River at Trimble Road	San Jose	180500030304 Guadalupe River	37.38062	-121.93802

Appendix 3. Priority pesticides for the Sacramento area based on acute and chronic toxicity values. Listed, pesticides with priorities greater or equal to the priority score of 9, with a "TRUE" monitoring recommendation from SWMP (based on acute toxicity). Priority model does not include homeowner pesticide use. Screen codes: DN, dinitroaniline herbicides, oxyfluorfen, and chlorfenapyr; GLY, glyphosate herbicides; LC, liquid chromatography multi-analyte; PY, pyrethroid; PX, phenoxy/synthetic auxin herbicides; NEO, neonicotinoids.

Pesticide	CDFA Screen	2021-2023 Average Use (lb ai)	Use Score	Benchmark (µg/L)	Tox Score	Final Score	Monitored?
Bifenthrin	PY	11772.5	5	0.00005	8	40	Y
Permethrin	PY	32251	5	0.0033	7	35	Y
Esfenvalerate	PY	3045.8	4	0.0000309	8	32	Y
Cypermethrin	PY	1869.2	4	0.00005	8	32	Y
Deltamethrin	PY	1491.6	4	0.0000260	8	32	Y
Imidacloprid	NEO	2509.8	4	0.01	7	28	Y
Fipronil	LC	1531	4	0.01	6	24	Y
Lambda-cyhalothrin	PY	853.1	3	0.00004	8	24	Y
Alpha-cypermethrin	None	419.1	3	0.00059	8	24	N*
Pendimethalin	DN	2541.6	4	5.2	4	16	Y
Dithiopyr	None	2372.3	4	6.11	4	16	N
Cyfluthrin	PY	247	2	0.00012	8	16	Y
Prallethrin	None	760.7	3	0.65	5	15	N*
Diuron	LC	755.3	3	0.13	5	15	Y
Glufosinate-ammonium	GLY	2069.8	4	72	3	12	Y
Isoxaben	LC	1094.5	3	10	4	12	Y
Prodiamine	DN	1076	3	1.5	4	12	Y
Chlorfenapyr	DN	358.1	3	2.91	4	12	Y
Pyriproxyfen	LC	97.8	2	0.01	6	12	Y
Novaluron	None	62.4	2	0.03	6	12	N*
Oxadiazon	LC	210.2	2	0.88	5	10	Y
Diazinon	LC	119.1	2	0.1	5	10	Y
Oxyfluorfen	LC	110.1	2	0.33	5	10	Y
Sulfometuron-methyl	None	63.3	2	0.45	5	10	N*
Triclopyr, butoxyethyl ester	PX	1123	3	26	3	9	Y
Indoxacarb	LC	422.2	3	75	3	9	Y
Propiconazole	LC	421.9	3	15	3	9	Y

*AI not monitored due to the lack of analytical methods.

Appendix 4. Priority pesticides for San Francisco Bay area sampling sites based on acute and chronic toxicity values. Listed, pesticides with priorities greater or equal to the priority score of 9, with a "TRUE" monitoring recommendation from SWMP (based on acute toxicity). Priority model does not include homeowner pesticide use. Screen codes: DN, dinitroaniline herbicides, oxyfluorfen, and chlorfenapyr; GLY, glyphosate herbicides; LC, liquid chromatography multi-analyte; PY, pyrethroid; PX, phenoxy/synthetic auxin herbicides.

Pesticide	CDFA Screen	2019-2021 Average Use (lb ai)	Use Score	Benchmark (µg/L)	Tox Score	Final Score	Monitored?
Permethrin	PY	8695	5	0.0033	7	35	Y
Bifenthrin	PY	4701.5	4	0.00005	8	32	Y
Imidacloprid	NEO	2083.2	4	0.01	7	28	Y
Fipronil	LC	2435.3	4	0.01	6	24	Y
Lambda-cyhalothrin	PY	1182.1	3	0.00004	8	24	Y
Deltamethrin	PY	963.7	3	0.000026	8	24	Y
Cyfluthrin	PY	428.4	3	0.00012	8	24	Y
Dithiopyr	None	4084	4	6.11	4	16	N*
Pendimethalin	DN	2436.8	4	5.2	4	16	Y
Alpha-cypermethrin	None	337.7	2	0.00059	8	16	N*
Esfenvalerate	PY	279.8	2	0.0000309	8	16	Y
Diuron	LC	501.9	3	0.13	5	15	Y
Triclopyr, butoxyethyl ester	PX	2914.9	4	26	3	12	Y
Glufosinate-ammonium	GLY	2089.5	4	72	3	12	Y
Prodiamine	DN	865.5	3	1.5	4	12	Y
Chlorfenapyr	DN	645.4	3	2.91	4	12	Y
Isoxaben	LC	586.7	3	10	4	12	Y
Clothianidin	NEO	374.2	2	0.05	6	12	Y
Pyriproxyfen	LC	260.6	2	0.01	6	12	Y
Oxyfluorfen	DN	283.4	2	0.33	5	10	Y
Oxadiazon	LC	146.3	2	0.88	5	10	Y
Thiamethoxam	LC	67.9	2	0.74	5	10	Y
PCNB	None	719.9	3	13	3	9	N*
Propiconazole	LC	585.4	3	15	3	9	Y

*AI not monitored due to the lack of analytical methods.

Appendix 5. Chemical analyses of pesticides in Northern California urban monitoring Study 329. CDFA will analyze all water samples.

Analyte Screen (Method ID)	Pesticide	Reporting Limit (ng L^{-1})	Method Detection Limit (ng L^{-1})
Dinitroaniline (DN) (EMON-SM-05-006)	benfluralin	50	19.9
	chlorfenapyr	100	33.3
	ethalfluralin	50	14
	oxyfluorfen	50	10
	pendimethalin	50	12
	prodiamine	50	12
	trifluralin	50	14
LC-multi analyte (LC) (EMON-SM-05-037)	abamectin	20	4
	acetamiprid	20	4
	atrazine	20	4
	azoxystrobin	20	4
	bensulide	20	4
	boscalid	20	4
	bromacil	20	4
	carbaryl	20	4
	chlorantraniliprole	20	4
	chlorpyrifos	20	4
	cyprodinil	20	4
	desulfinyl fipronil	10	4
	desulfinyl fipronil amide	10	4
	diazinon	20	4
	diflubenzuron	20	4
	dimethoate	20	4
	diuron	20	4
	ethoprop	20	4
	etofenprox	20	4
	fenamidone	20	4
	fenhexamid	20	4
	fipronil	10	4
	fipronil amide	10	4
	fipronil sulfide	10	4
	fipronil sulfone	10	4
	fludioxonil	20	4
	hexazinone	20	4
	imidacloprid	10	4
	indoxacarb	20	4
	isoxaben	20	4
	kresoxim-methyl	20	4
	malathion	20	4
	methidathion	20	4
	methomyl	20	4
	methoxyfenozide	20	4
	metribuzin	20	4
	norflurazon	20	4
	oryzalin	20	4
	oxadiazon	20	4
	prometon	20	4
	prometryn	20	4
	propanil	20	4

Analyte Screen (Method ID)	Pesticide	Reporting Limit (ng L^{-1})	Method Detection Limit (ng L^{-1})
	propargite	20	4
	propiconazole	20	4
	pyraclostrobin	20	4
	pyriproxyfen	15	4
	quinoxyfen	20	4
	simazine	20	4
	s-metolachlor	20	4
	tebuconazole	20	4
	tebufenozide	20	4
	tebuthiuron	20	4
	thiabendazole	20	4
	thiacloprid	20	4
	thiamethoxam	20	4
	trifloxystrobin	20	4
Pyrethroid (PYW) (EMON-SM-05-022)	bifenthrin	1	0.91
	cyfluthrin	2	1.46
	cypermethrin	5	1.54
	deltamethrin/tralomethrin	5	1.77
	esfenvalerate/fenvalerate	5	1.66
	fenpropathrin	5	1.4
	lambda-cyhalothrin	2	1.74
	permethrin cis	2	1.05
	permethrin trans	5	1.05
Phenoxy/Synthetic Auxin Herbicides (PX) (EMON-SM-05-012)	2,4-D	50	15
	dicamba	50	17
	MCPA	50	22
	triclopyr	50	20
Neonicotinoids (NEO) (EMON-SM-05-052)	Clothianidin	20	4
	Dinotefuran	20	4
	Sulfoxaflor	20	4
	Imidacloprid-d4	20	4
Glyphosate (GLY) (EM-SM-05-046)	AMPA	200	28
	Glufosinate	70	11.5
	Glyphosate	70	5

Appendix 6. Chemical analysis of pyrethroids in Northern California urban monitoring Study 329. CDFA will analyze sediment samples (Method EMON-SM 52-9 [PYS]).

Pesticide	Method Detection Limit (ng g^{-1} dry wt)	Reporting Limit (ng g^{-1} dry wt)
Bifenthrin	0.1083	1.0
Cyfluthrin	0.183	1.0
Cypermethrin	0.107	1.0
Deltamethrin/Tralomethrin	0.0661	1.0
Esfenvalerate/Fenvalerate	0.143	1.0
Lambda-cyhalothrin	0.1154	1.0
Permethrin cis	0.1159	1.0
Permethrin trans	0.1352	1.0