



Pesticide Source Control Actions Effectiveness Evaluation

*Submitted on behalf of all SCVURPPP Permittees in Compliance with Provision C.9.g
of the Municipal Regional Permit (Order R2-2015-0049)*

September 30, 2019

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List of Abbreviations

303(d) List	List of Impaired Waters under Section 303(d) of the Federal Clean Water Act
BASMAA	Bay Area Stormwater Management Agencies Association
BMP	Best Management Practice
CASQA	California Stormwater Quality Association
DPR	California Department of Pesticide Regulation
HHW	Household Hazardous Waste
IFMA	International Facility Management Association
LC ₅₀	Lethal Concentration 50% - i.e., the dose required to kill half the members of a tested population after a specified test duration
MRP	Stormwater NPDES Municipal Regional Permit (Order R2-2015-0049)
NPDES	National Pollutant Discharge Elimination System
OSH	Orchard Supply Hardware
O&M	Operation and Maintenance
OWOW	Our Water Our World
PCO	Pest Control Operator
RMC	BASMAA Regional Monitoring Coalition
SFEI	San Francisco Estuary Institute
SCVURPPP	Santa Clara Valley Urban Runoff Pollution Prevention Program
SOP	Standard Operating Procedure
SPoT	Stream Pollutant Trend Monitoring Project (Statewide SWAMP)
SWAMP	California Surface Water Ambient Monitoring Program
SWRCB	State Water Resource Control Board
TMDL	Total Maximum Daily Load
USEPA	United States Environmental Protection Agency
WQAS	Water Quality Attainment Strategy
WQOs	Water Quality Objectives

1.0 INTRODUCTION

This *Pesticide Source Control Actions Effectiveness Evaluation* addresses the requirements of Provision C.9.g of the Municipal Regional Stormwater NPDES Permit (MRP) (SFBRWQCB 2015) - Evaluate Implementation of Source Control Actions Relating to Pesticides. This provision requires Permittees to:

- Evaluate the effectiveness of the control measures implemented by staff and contractors (per MRP Provisions C.9.a - e and g);
- Evaluate the attainment of pesticide concentration and toxicity targets for water and sediment from monitoring data (collected by MRP Permittees, research agencies, and/or State agencies) and any changes in water quality regarding pesticide toxicity in urban creeks; and,
- Identify improvements to existing control measures and/or additional control measures, if needed, to attain targets with an implementation time schedule, including a brief description of one or more pesticide-related area(s) the Permittee will focus on enhancing during the subsequent permit term.

The MRP includes requirements associated with pesticides because regulatory agencies have previously identified pesticides as causing water and/or sediment toxicity and impairing beneficial uses of San Francisco Bay Area (Bay Area) creeks and determined that urban stormwater is a likely cause or contributor to the impairment (SFBRWQCB 2015). This report describes the source control measures implemented by the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP or Program) and its 15 permittee agencies¹ and provides an evaluation of the effectiveness of the control measures using effectiveness assessment outcomes developed by the California Stormwater Quality Association (CASQA) (CASQA 2015). The effectiveness of pesticide control measures is assessed using both implementation and water quality outcomes, including a comparison to receiving water quality targets.

This evaluation also includes a discussion of improvements made by each SCVURPPP permittee in implementing pesticide source control actions in approximately the preceding five years (FY 13-14 to FY 17-18²), and enhancements that each Permittee plans to make during the next permit term.

2.0 BACKGROUND

2.1. Water Quality Impairment and Bay Area Urban Creeks TMDL

During the early 1990s, organophosphate pesticides were identified as causing water column toxicity in Bay Area urban creeks (SWRCB et al. 1997). The toxicity was observed via bioassays using *Ceriodaphnia dubia*, an indicator organism used in laboratory tests to assess surface water toxicity and evaluate biological community responses. The concentration of diazinon in water samples from urban creeks throughout the Bay Area was often high enough to account for the observed water column toxicity and diazinon was identified as the primary cause of the toxicity.

¹SCVURPPP's permittee agencies are 13 cities/towns, the County of Santa Clara, and Valley Water (formerly the Santa Clara Valley Water District).

²If available, data for FY 18-19 are also included.

In May 1999, the U.S. Environmental Protection Agency (USEPA) listed San Francisco Bay and 35 Bay Area urban creeks as impaired by diazinon under Section 303(d) of the federal Clean Water Act (USEPA 1998). In 2000, because of growing concerns about the effects organophosphate chemicals have on human health, the USEPA announced an agreement with pesticide manufacturers to remove most products containing diazinon and chlorpyrifos from retail store shelves and end most residential and professional uses by the end of 2004. As a result, urban uses of diazinon and chlorpyrifos declined substantially. These pesticides have generally not been detected in Santa Clara County creeks since 2005 (See Section 4.0). The phase-out of diazinon, however, resulted in increased use of alternative pesticides and new pesticides entering the market place. Replacements for organophosphate pesticides included pyrethroids, carbamates and fipronil.

In 2005, the San Francisco Bay Regional Water Quality Control Board (Regional Water Board) adopted the Total Maximum Daily Load (TMDL) and Water Quality Attainment Strategy (WQAS) for diazinon and pesticide-related toxicity in San Francisco Bay area urban creeks (SFRBWQCB 2005). Because it was anticipated that the phase-out of diazinon could lead to the use of other pesticides that could potentially cause toxicity, the TMDL/WQAS targeted diazinon specifically, while concurrently addressing the potential for other pesticide-related toxicity in urban creeks. The following water and toxicity targets were established through the TMDL/WQAS:

- **Toxicity Targets** - no pesticide-related acute or chronic toxicity in urban creeks in excess of 1.0 TU_a or 1.0 TU_c :

where:

$TU_a = 100 / \text{No Observable Adverse Effects Concentration (NOAEC)}$

$TU_c = 100 / \text{No Observable Effects Concentration (NOEC)}$

NOAEC = statistically significant differences between acute endpoints in sample and control

NOEC = statistically significant differences between chronic endpoints in sample and control

NOAEC and NOEC are both expressed as the percentage of a sample in a test container (e.g., an undiluted sample has a concentration of 100%). In both cases, an observable effect must be statistically significant. An undiluted ambient water or sediment sample that does not exhibit an acute or chronic toxic effect that is significantly different from control samples on a statistical basis shall be assumed to meet the relevant target.

- **Diazinon Target** - The one-hour average concentration of diazinon in freshwater shall not exceed 100 ng/l.

As described in the TMDL/WQAS, the goal of the implementation strategy is to eliminate and prevent pesticide-related toxicity in Bay Area urban creeks. The overarching strategy to reach this goal is to encourage pest management alternatives that do not threaten water quality and to discourage the use of pesticides that run off and threaten water quality, which can best be accomplished through the application of Integrated Pest Management (IPM) techniques and the use of less toxic pest control

methods (SFBRWQCB 2005). The TMDL includes proposed actions that focus on effective IPM implementation, proactive regulation, education and outreach, and research and monitoring. Requirements included in Provision C.9 of the MRP are consistent with the actions outlined in TMDL/WQAS.

2.2. Pesticide Regulation and Oversight

Several agencies and organizations oversee pesticide use and pesticide discharges. Those with the broadest authorities include the USEPA and the California Department of Pesticide Regulation (DPR). Gaps in pesticide regulatory program implementation allow pesticides to be used in ways that result in discharges that impair beneficial uses in San Francisco Bay Area urban creeks. The role of the Regional Water Board in reducing pesticide-related toxicity in urban creeks is to encourage, monitor, and enforce implementation actions, and to lead by example (SFBRWQCB 2005). Local governments in the Bay Area are responsible for managing urban runoff discharges through Municipal Separate Storm Sewer System (MS4) National Pollutant Discharge Elimination System (NPDES) permits, but California law generally prohibits these agencies from regulating the registration, sale, transportation, or use of pesticides. SCVURPPP's permittee agencies are therefore limited in their ability to reduce the concentrations and impacts of pesticides in discharges from stormwater conveyances. Pesticide control measures implemented by permittee agencies are focused primary on practicing and encouraging IPM and participating in regulatory processes to ensure water quality impacts are considered during the pesticide re-registration and approval process. These control measures are described later in this document.

2.3. Current Urban-use Pesticides of Concern

The MRP identifies the following as the pesticides of primary concern to water quality in Bay Area urban creeks.

- Organophosphate products (example active ingredients: diazinon, chlorpyrifos, malathion);
- Carbamate products (example active ingredients: carbaryl and aldicarb³);
- Pyrethroid products (example active ingredients: bifenthrin, cyfluthrin, beta-cyfluthrin, cypermethrin, deltamethrin, esfenvalerate, lambda-cyhalothrin, permethrin, and metofluthrin);
- Fipronil and its degradates;
- Diamides (example Active Ingredients: chlorantraniliprole and cyantraniliprole);
- Diuron; and
- Indoxacarb

While not mentioned as a pesticide of concern in Provision C.9, the MRP requires that Permittees monitor for imidacloprid (see Section 2.4.2).

³ Currently, there are no registered pesticides in California containing the active ingredient aldicarb. EPA banned the primary aldicarb containing pesticide, Temik, in 2010, requiring an end to distribution by 2017.

2.4. MRP Requirements

Provision C.9 of the MRP requires Permittees to implement pesticide toxicity control programs based on the concepts of Integrated Pest Management (IPM) to address the use of pesticides that pose a threat to water quality and have a potential to enter their MS4.

Consistent with the requirements of Provision C.9, SCVURPPP Permittees implement source control and pollution prevention actions that can potentially reduce the use of the pesticides of concern. These include robust outreach efforts to residents and businesses, providing training to municipal staff on IPM practices, and requiring municipal contractors to implement IPM. Local training and regional outreach efforts have been supplemented by monitoring studies to define the problem and track trends, participation in regional efforts to address pesticide regulations (e.g., related to registration) and other issues, and development of local municipal IPM plans.

2.4.1. Source Control Measures

SCVURPPP and its participating agencies have implemented source control measures to control pesticide pollution for over 15 years. Based on requirements in its 2001 municipal stormwater NPDES permit, SCVURPPP developed a Pesticide Management Plan (Plan) to control pesticide-related toxicity attributable to urban runoff. The Plan identified specific source control measures, the goals of each source control measure, specific actions, monitoring mechanisms, and implementation schedules (SCVURPPP 2002). The monitoring mechanisms were actions that measure progress toward achieving the stated goals. The Plan also identified whether actions will be implemented at the Program level, municipality level, or both.

Though the Plan was developed as a 5-year plan, implementation of tasks continued with subsequent permits, including the MRP. Source control measures were enhanced, as needed, to meet MRP requirements. Currently, source control measures include the following:

- Adopting and implementing IPM policies/ordinances and establishing Standard Operating Procedures;
- Training municipal staff on IPM techniques;
- Requiring contractors to implement IPM;
- Communicating with County Agricultural Commissioners;
- Participating in regulatory processes to ensure water quality impacts are considered in the pesticide re-registration and approval process;
- Conducting outreach to residents and pest control professionals to promote IPM; and,
- Minimizing pesticide use at new development and redevelopment project sites.

These source control measures are described in detail later in this report.

2.4.2. Monitoring Program

SCVURPPP began implementing a creek water quality monitoring program before the adoption of the MRP. Monitoring included collecting water and sediment samples from selected urban creeks and analyzing for organophosphate and pyrethroid pesticides and toxicity. The results of this monitoring were summarized in several technical reports submitted to the Regional Water Board (e.g., SCVURPPP 2002, 2007, and 2008).

MRP Monitoring

With the adoption of the MRP in 2012, SCVURPPP began implementing new monitoring requirements as a participant in the Bay Area Stormwater Management Agencies Association (BASMAA) Regional Monitoring Coalition (RMC). From 2012 through 2015, per Provision C.8.c of MRP 1.0, SCVURPPP conducted annual dry season monitoring at three locations for toxicity in water and sediments and pesticides in sediments. Water column samples were collected from the same three locations each year during a storm event for toxicity testing. The sampling locations were designated through a probabilistic monitoring design (BASMAA 2011a) and sampling was conducted using standard protocols (BASMAA 2012). The suite of parameters monitored included legacy pesticides such as DDT and dieldrin as well as pyrethroid pesticides in sediment. Water column toxicity was assessed using three test organisms, *Pimephales promelas* (fathead minnow), *Ceriodaphnia dubia* (a crustacean), and *Selenastrum capricornutum* (a green algae), and sediment toxicity was assessed using *Hyalella azteca* (an amphipod).

In 2016, with the adoption of MRP 2.0, SCVURPPP conducted pesticides and toxicity monitoring in compliance with Provision C.8.g. Dry weather monitoring is conducted at two locations per year and 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: *Hyella azteca* (survival) and *Chironomus dilutus* (survival).
- Sediment chemistry analytes include pyrethroids, fipronil, carbaryl, total polycyclic aromatic hydrocarbons (PAHs), metals, Total Organic Carbon (TOC), and sediment grain size.

Wet weather monitoring under MRP 2.0 includes collection of water samples during storm events for toxicity testing (using the same five organisms required for dry weather toxicity testing) and analysis of pyrethroids, fipronil, and imidacloprid. Although indoxacarb is included on the list of constituents, there is currently no available analytical method. As part of the RMC, SCVURPPP was required to collect a total of three wet weather samples, which were collected during a single storm event in Water Year (WY) 2018 (i.e., October 1, 2017 through September 30, 2018).

Toxicity and chemistry data collected as part of MRP monitoring are analyzed to evaluate potential stressors (including pesticides) that may impact water quality. The monitoring results are compared to water quality objectives (WQOs) and monitoring trigger thresholds specified in the MRP. Results that exceed WQOs or monitoring trigger thresholds may lead to additional monitoring to confirm or identify

stressors and/or sources of impacts and their spatial extents, and/or the implementation of management actions to minimize the impacts associated with urban runoff.

Upper Penitencia Creek Stressor/Source Identification Project

In WY 2016, SCVURPPP conducted a stressor/source identification (SSID) project in Upper Penitencia Creek to investigate sources of poor biological condition, based on the California Stream Condition Index (CSCI) score for benthic macroinvertebrate (BMI) data. Several potential stressors were investigated, including sediment chemistry and toxicity (SCVURPPP 2017).

Coyote Creek Stressor/Source Identification Project

In WY 2017, SCVURPPP initiated an SSID project in Coyote Creek to investigate sources of sediment toxicity identified through prior monitoring. The Coyote Creek SSID Work Plan (SCVURPPP 2018) was submitted to the Regional Water Board on March 31, 2018 and satisfies the MRP regional requirement for one toxicity SSID project. In 2018, SCVURPPP conducted the first phase of the SSID project field effort by collecting sediment samples from five locations and analyzing the samples for pyrethroids and toxicity to *Hyalella azteca* (survival).

Statewide Monitoring Program

Under Objective 6 of the Strategy to Optimize Resource Management of Storm Water (STORMS), adopted by the California State Water Resources Control Board (State Water Board) in January 2016, the State Water Board is developing a statewide framework for urban pesticides reduction (Urban Pesticides Amendments). The primary goal of the statewide Urban Pesticides Amendments is to improve collaboration among regulators, leading to better management of pesticides in urban runoff. The Amendments will also organize coordinated pesticides and toxicity monitoring and data sharing.

The Urban Pesticides Amendments team is proposing a statewide monitoring program that will substitute for pesticides and toxicity monitoring requirements in MS4 permits, such as the MRP. The goal is to generate useful data at minimal cost. The Draft Amendments will likely be released for public review in early 2020 with adoption anticipated in mid-2020. At this time, the mechanism for implementing the statewide monitoring program is uncertain.

2.5. Effectiveness Evaluation

This report evaluates the effectiveness of source control measures implemented by SCVURPPP and its permittees. The evaluation uses “Outcome Levels” described by CASQA (2015) in *A Strategic Approach to Planning for an Assessing the Effectiveness of Stormwater Program* (Guidance Manual). Information on the level of implementation and associated data (e.g., local implementation of IPM Policy, trends in use of pesticides impacting water quality, and number of staff trained in IPM) used to assess the effectiveness of pesticide source controls were obtained from SCVURPPP and permittee agency Annual Reports. Water quality monitoring data collected by SCVURPPP and other agencies (e.g., Regional Water Board) were also compiled and summarized to assess progress towards achieving the TMDL/WQAS targets described in Section 2.1.

2.6. Evaluation Methodology

The CASQA effectiveness assessment approach utilizes a general model that relates three primary components to the six outcome levels and associated, general outcome types. The three primary components are:

- Stormwater Programs (Outcome Level 1) – Stormwater programs are the road map for the improvements that managers wish to attain in receiving waters. Their immediate purpose is to describe programs that will facilitate changes in the behaviors of key target audiences. This component is typically assessed on a short-term basis.
- Target Audiences (Outcome Levels 2-3) – This component focuses on understanding the behaviors of the people responsible for source contributions. It explores the factors that determine existing behavioral patterns and looks for ways to replace polluting behaviors with non-polluting behaviors. This component is typically assessed on a short- and/or long-term basis.
- Sources and Impacts (Outcome Levels 4-6) – This component addresses the generation, transport, and fate of urban runoff pollutants. It includes sources (sites, facilities, areas, etc.), stormwater conveyance systems, and the water bodies that ultimately receive the source discharges (receiving waters). This component is typically assessed on a long-term and/or regional basis.

The six categories of outcome levels establish a logical and consistent organizational scheme for assessing and relating individual outcomes. According to the CASQA Guidance Manual, “outcomes” are the results of implementing a stormwater control measure, program activity or element, or overall program. Each control measure or activity can lead to one or more “Outcome Levels.” The six Outcome Levels described in the Guidance Manual are summarized below:

1. **Outcome Level 1: Stormwater Program Activities** – Many specific activities are either prescribed by or established under stormwater permits. The most basic means of assessing effectiveness is to determine compliance with activity-based permit requirements. Level 1 Outcomes may take the form of a simple yes/no answer.
2. **Outcome Level 2: Barriers and Bridges to Action** – A goal of most stormwater management programs is to increase the level of knowledge and awareness among target audiences. Measuring Level 2 Outcomes is a useful way of gauging whether outreach, training, or other program activities are producing changes in awareness, knowledge, or attitudes of target audiences. Various methods and tools, both quantitative and qualitative, are currently utilized to measure changes in knowledge and awareness. These methods generally take the form of surveys and quizzes.
3. **Outcome Level 3: Target Audience Actions** – Water quality improvements can be achieved only when specific actions have occurred in one or more target audiences. Building on increases in knowledge and awareness, a key focus of stormwater management programs is to effect changes in behavior in the target audiences. Level 3 Outcomes measure the effectiveness of programs in motivating target audiences to change their behaviors and implement appropriate control measures. Methods used to measure behavioral changes include those described above

for Level 2 Outcomes and direct observation via site visits and reporting by dischargers or third parties.

4. **Outcome Level 4: Source Contributions** – Many activities implemented through stormwater management programs are intended to reduce the loading of pollutants or runoff volumes from targeted sources. A source is anything with the potential to generate urban runoff flow or pollutants prior to their introduction to the storm drain system. Load reductions should in turn result in improvements to discharge and receiving water quality. Load reductions quantify changes in the amounts of pollutants associated with specific sources before and after one or more control measures are employed.
5. **Outcome Level 5: MS4 Contributions** – A primary focus of stormwater management programs is to reduce pollutants in stormwater and non-stormwater discharges to the maximum extent practicable, and to ensure that these discharges do not cause or contribute to violations of WQOs in receiving waters. Level 5 Outcomes may be measured as reductions in one or more specific pollutants in MS4 discharges, and may reflect effectiveness at a variety of scales ranging from site-specific to programmatic.
6. **Outcome Level 6: Receiving Water Conditions** – The ultimate objective of stormwater management programs is the protection of water bodies receiving discharges from MS4s. Changes to receiving water and environmental quality may be expressed through a variety of outcomes such as achievement of WQOs and TMDL targets, protection of biological integrity, and beneficial use attainment.

Once the desired outcomes of program implementation have been defined, specific assessment measures are used to determine whether or how successfully a programmatic or water quality outcome has been achieved. They may be qualitative (e.g., yes/no) or quantitative (e.g., % of targeted audience reached, % reduction in a constituent level). All priority outcomes have at least one assessment measure associated with them, but some may have multiple measures.

On a broader scale, there are two general categories of effectiveness assessments: 1) Implementation Assessments; and 2) Water Quality Assessments. These categories of assessments are differentiated by whether the type of outcome is implementation-based or water quality-based. Implementation assessments include those evaluations conducted at levels 1 - 4, and water quality assessments are those conducted at levels 5 and 6. Section 3.0 and Section 4.0 discuss the results of both implementation and water quality assessments conducted to evaluate the effectiveness of pesticide source control measures implemented by SCVURPPP and its Permittees.

3.0 IMPLEMENTATION ASSESSMENT RESULTS (LEVELS 1 - 4)

This section evaluates the effectiveness of the source control measures described in Section 2.4.1. These measures are consistent with the requirements in Provision C.9 of the MRP.

3.1. Maintaining and Implementing IPM Policies/Ordinances and Standard Operating Procedures (SOPs)

The goal of this control measure is to establish structural and landscape pest control guidelines for municipal staff and pest control contractors. Adopting an IPM policy/ordinance demonstrates a local agency's commitment to reducing pesticide use. The effectiveness of this source control measure is assessed at Outcome Levels 1, 2, 3 and 4.

Outcome Level 1 - Stormwater Program Activities

All SCVURPPP Permittees have adopted IPM Policies/ Ordinances and established detailed IPM Plans and pesticide application Standard Operating Procedures (SOPs). The date of adoption of IPM Policies by SCVURPPP Permittees is below:

- City of Palo Alto – 2001
- Santa Clara Valley Water District – 2001, revised 2010
- West Valley Cities (Campbell, Saratoga, Monte Sereno and Los Gatos) – 2002
- City of Mountain View – 2002
- County of Santa Clara – 2002
- City of Sunnyvale – 2002, revised 2010
- City of Cupertino – 2002, updated in 2008 and 2011
- City of San Jose – 2003
- City of Milpitas - 2004, revised 2012
- City of Los Altos and Town of Los Altos Hills – 2010
- City of Santa Clara –2012⁴

Outcome Level 2: Barriers and Bridges to Action

Staff trainings are used to raise the awareness of and update municipal staff on IPM policies/ordinances and the agency's commitment to using less-toxic pest management techniques. All contractors are made aware of and required to apply pesticides in a manner consistent with IPM policies/ordinances. Additionally, pesticide application SOPs describe the pest control procedures that municipal staff and contractors must follow.

Outcome Level 3: Target Audience Actions and Outcome Level 4 - Source Contributions

One indicator of behavior change and source reduction associated with municipal use of pesticides of concern is the amount of pesticides applied annually by SCVURPPP Permittees. Another measure is demonstration of IPM tactics that Permittees have implemented. SCVURPPP Permittees report both of

⁴ The City of Santa Clara had an in-house IPM Program until 2012. The IPM Policy was officially adopted in 2012.

these via their Annual Reports to the Regional Water Board. IPM tactics employed by Permittees are further described in Section 5.0 of this report.

Pesticide use data reported in Permittee Annual Reports were reviewed and a preliminary evaluation conducted to better understand whether pest control practices have changed. The results of the evaluation indicated that Permittees are using pesticides of concern sparingly, and only as a last resort.

- Nine Permittees reported that they have not used any pesticides of concern from FY 2013-14 to FY 2017-18. One Permittee reported using a pesticide of concern in one fiscal year from FY 2013-14 to FY 2017-18. Five Permittees reported using a pesticide of concern in more than one fiscal year.
- The pesticides of concern that Permittees reported using are pyrethroids, fipronil, indoxacarb, and organophosphates.
- Permittees did not report using any other pesticides of concern (carbamates, diuron, and diamides) from FY 13-14 – FY 17-18.

Table 3-1 shows the pesticides of concern usage reported by Permittee agencies. The data indicate that pesticides of concern are used occasionally, and in small quantities. The permittee agencies that reported using pesticides of concern did so only as a last resort and provided a reason for the use within the Annual Report. In most cases, the pesticides of concern were applied in small quantities and the agency indicated that staff was working with the pesticide applicators to reduce or eliminate the use.

Table 3-1 Summary of Pesticide of Concern Use by SCVURPPP Permittees between FY 13-14 and FY 17-18

Permittee	FY 13-14	FY 14-15	FY 15-16	FY 16-17	FY 17-18
Campbell	4 oz of Tengard (contains permethrin) ⁵ ; 2oz of Suspend ⁵ (contains deltamethrin)	None used	None used	None used	5.5 g of beta-cyfluthrin; 720oz of diuron
Cupertino	None used	None used	None used	None used	None used
Los Altos	None used	None used	None used	None used	None used
Los Altos Hills	None used	None used	None used	None used	None used
Los Gatos	None used	None used	None used	None used	None used
Milpitas	None used	None used	None used	None used	None used
Mountain View	0.002 lb deltamethrin; 0.02 lb beta-cyfluthrin; 0.005 lb permethrin; 0.02 lb D-trans-allethrin; 0.06003 lb fipronil;	0.15 beta-cyfluthrin; 0.001 lb D-trans allethrin; 0.14001 lb fipronil;	0.05 lb beta-cyfluthrin; 0.007 lb permethrin; 0.4 lb fipronil	0.09 lb beta-cyfluthrin; 3.2 lb permethrin; 0.002 lb of tetramethrin; 0.002 lb of indoxacarb; 1.4 lb of fipronil;	0.1 lb of beta-cyfluthrin; 1.02 lb of permethrin; 0.02 lb of tetramethrin; 0.08 lb of fipronil
Palo Alto	None used	None used	None used	0.1 lb of indoxacarb	None used
San Jose	0.01 lb deltamethrin; 0.14 lb permethrin; 0.005lb carbaryl, 0.07lb fipronil	0.00375 lb cyfluthrin; 0.00048 d-trans allethrin; 0.00119 deltamethrin; 0.08280 lb permethrin; 0.00045 phenothrin, 0.07506 fipronil	0.00525lb beta-cyfluthrin; 0.00682lb deltamethrin; 0.46230lb Permethrin; 0.10098lb fipronil	0.00252 lb deltamethrin; 0.16723lb permethrin; 0.07912 lb fipronil; 0.04989 lb indoxacarb;	0.00394 lb of beta-cyfluthrin; 0.00534 lb of deltamethrin; 0.07360 lb of permethrin; 0.01782 lb of fipronil; 851 lb of diuron
Santa Clara	None used	None used	None used	None used	None used
Saratoga	305 oz of Astro ⁵ (contains permethrin)	345 oz of Astro ⁵ (contains permethrin)	110.4 oz permethrin; 2oz fipronil	110.768 oz of permethrin	110.768 oz of permethrin; 0.6oz of beta-cyfluthrin

⁵ Total quantity of product used; not total quantity of active ingredient.

Permittee	FY 13-14	FY 14-15	FY 15-16	FY 16-17	FY 17-18
Sunnyvale	101.9 oz of cyfluthrin; 0.01 oz d-transallethrin; 0.00004 oz fipronil	80 oz cyfluthrin; 0.015 oz d-transallethrin; 0.00728 oz fipronil	59.6oz of beta-cyfluthrin; 47.1 oz of permethrin; 0.00005 oz of fipronil	128.1oz of beta-cyfluthrin; 0.0004 oz of fipronil; 0.0000965 oz of Indoxacrb	0.7275 oz of beta-cyfluthrin; 0.092 oz of permethrin
Santa Clara County	None used	None used	None used	None used	None used
Valley Water	None used	None used	None used	None used	None used

Note: Prior to FY 15-16, reporting the quantity of active ingredients was not required. Some Permittees reported the total quantity of the pesticide product used.

3.2. Municipal Staff Training

The intent of trainings for municipal staff is to: 1) raise awareness of all municipal employees about IPM, and 2) train employees who apply pesticides about the municipality’s IPM Policy and/or IPM techniques as appropriate. The effectiveness of this source control measure is assessed at Outcome Levels 1, 2, 3 and 4.

Outcome Level 1 - Stormwater Program Activities

All SCVURPPP permittee agencies ensure that staff responsible for applying pesticides is familiar with their agency’s IPM Policy, SOPs and new and current IPM techniques. Permittees also send staff to trainings organized by other organizations (e.g., Bay Friendly Landscaper Training, Pesticide Applicators Professional Association’s IPM Trainings). An evaluation of Annual Report data indicates the following:

- Two SCVURPPP permittees do not have employees that apply pesticides.
- All SCVURPPP permittees that have employees that apply pesticides conduct annual trainings to ensure that these employees are trained on the permittee agency’s IPM policy/ordinance, and IPM techniques.

Table 3-2 summarizes the training data from FY 15-16⁶ to FY 17-18.

Table 3-2 Summary of Permittee Employee Trainings

Metric	FY 15-16	FY 16-17	FY 17-18
Total number of SCVURPPP Permittee employees that applied or used pesticides	323	422	379
Total number of SCVURPPP Permittee employees that received trainings on the IPM policy and procedures	318	422	379
Percentage of SCVURPPP Permittee employees that apply pesticides and have received training in the IPM policy and IPM standard operating procedures each year.	98%	100%	100%

⁶ Prior to FY 15-16, Permittees were not required to report on annual training.

Outcome Level 2: Barriers and Bridges to Action

The IPM trainings help increase municipal staffs' awareness of IPM techniques. Generally, training content includes topics such as overview of IPM techniques, using IPM for managing pest problems, plant selection to avoid pest problems, and available less-toxic pest control products. By attending trainings, the awareness of municipal staff of IPM and the use of less toxic pesticides was increased.

Outcome Level 3: Target Audience Actions and Level 4 - Source Contributions

As discussed earlier, a preliminary analysis of the reported pesticide use data indicates that permittees are using minimal amounts of pesticides of concern.

3.3. Requiring Contractors to Implement IPM

The goal of this control measure is to ensure that all pest control contractors retained by SCVURPPP permittee agencies are familiar with the permittee's IPM policy and are able to address pest problems using IPM techniques. The effectiveness of this source control measure is assessed at Outcome Levels 1, 2, 3 and 4.

Outcome Level 1 - Stormwater Program Activities and Outcome Level 2: Barriers and Bridges to Action

All permittees agencies work closely with the contractors to ensure that IPM techniques are implemented. Contractor compliance is ensured via regular meetings and review of pest management techniques. An analysis of Annual Report data indicates the following:

- 13 of 15 permittee agencies have contract specifications that require contractors to follow the IPM Policy and implement IPM. The remaining two permittees do not hire contractors for pest control work. All contract specifications require that contractor follow the permittee's IPM Policy.
- Four Permittees require that contractors be IPM certified (e.g., Eco-wise, Green Pro and Green Shield) and/or obtain training from the Green Gardener or Bay Friendly Landscaping programs.

Outcome Level 3: Target Audience Actions and Outcome Level 4 - Source Contributions

As discussed earlier, a preliminary analysis of the reported pesticide use data indicates that permittees are using minimal amounts of pesticides of concern.

3.4. Participation in Regulatory Processes

The goal of this source control measure is to actively participate in regulatory processes to increase the level of consideration given to water quality by regulatory agencies during the pesticide approval and registration process. Improvements to the registration process (e.g., requiring formulations that minimize pesticides of concern to water quality) will reduce the impact that registered pesticides have on Bay Area water bodies. Active participation by SCVURPPP and its permittee agencies includes working with regional and state stormwater management organizations (BASMAA and CASQA) to communicate with the USEPA Office of Pesticide Programs (OPP) and California Department of Pesticide Regulation (DPR) the need to improve the pesticide registration process.

To address the problems caused by pesticides in California's urban waterways, CASQA collaborates with the State Water Board and the California Regional Water Quality Control Boards (Water Boards) in a coordinated statewide effort, referred to as the Urban Pesticides Pollution Prevention (UP3) Partnership. By working with the Water Boards and other water quality organizations, CASQA helps to address the water quality impacts of pesticides efficiently and proactively through the statutory authority of the DPR and OPP. The effectiveness of this source control measure is assessed at Outcome Levels 1, 2, 3, and 4.

Outcome Level 1 - Stormwater Program Activities

Since the early-2000s, SCVURPPP has provided funding (via BASMAA) to a CASQA project to track and participate in pesticide-related regulatory processes, with an emphasis on protecting water quality. This project tracks regulatory efforts, comments on pesticide re-registrations, and maintains other relevant communications with USEPA and DPR through meetings and letters. Implementation of this project has resulted in significant changes in pesticide regulation.

Outcome Level 2: Barriers and Bridges to Action and Outcome Level 3: Target Audience Actions

CASQA efforts, which have been supported and partly funded by SCVURPPP and BASMAA, have raised awareness about water quality-related pesticide issues and led to improvements in the pesticide approval and registration processes at USEPA and DPR. Recent achievements include:

- In direct response to continued communication from CASQA and UP3 regarding pyrethroid and fipronil water pollution in urban areas, DPR has implemented mitigation measures and is currently monitoring their effectiveness. If successful, DPR's mitigation actions could address water quality concerns and preclude the need for fipronil TMDLs for those water bodies.
- In response to a partner request based on information provided by CASQA, DPR routed a deltamethrin (a pyrethroid) registration application to its Surface Water Protection Program for review. The results of the review did not support registration, leading to the applicant removing all urban uses to the product label.
- CASQA commented on the indoxacarb product label modification. CASQA noted that an important part of the label (stipulating outdoor clean-up practices) was omitted from the proposed revised label. DPR pulled the product from the registration process.
- Based on urban use data provided by CASQA, EPA agreed to incorporate urban uses (rights-of-way and outdoor building paints, caulks, and sealants) in the registration review process for diuron, which is a water quality pesticide of concern identified in the MRP.
- During the indoxacarb registration review process, CASQA and its partners sought to prohibit application of granular products to any impervious surface or in locations where product may contact surface waters, storm drains, or gutters. EPA fully incorporated this comment. CASQA and its partners also sought requirements that no outdoor application be made when rainfall is forecast within 48 hours. Future labels will contain voluntary wording specifying a 24-hour window. CASQA requested efficacy data to reduce the area receiving treatments (building "perimeter band") to the minimum required for effective pest control. While it is not clear whether efficacy data were applied, the perimeter band was changed from a maximum of 10

feet to 7 feet. Lastly, CASQA requested a requirement of immediate sweep back from accidental application to impervious surfaces; future labels will include this as a guidance.

- In direct response to communication from CASQA and its partners, EPA agreed that construction site applicators take steps to prevent pollution from pre-construction termiticide treatments with the insecticide chlorfenapyr. The requirements are identical to ones for pyrethroid insecticides that were developed by EPA at CASQA's suggestion.

Outcome Level 4 - Source Contributions

The modifications to pesticide labels and changes to application guidelines are expected to reduce the quantities of pesticides of concern applied on outdoor impervious surfaces by professional applicators. This will reduce the quantity of these pesticides that can be washed directly into gutters and storm drains when it rains or when water (e.g., irrigation overflow) runs across treated surfaces.

3.5. Interface with County Agricultural Commissioners

The goal of this source control measure is to maintain communication with the County Agricultural Commissioner's office to update them on water quality issues related to pesticides, get their input and assistance on pest management practices, and report to them any observed or citizen-reported violation of pesticide regulations. The effectiveness of this source control measure is assessed at Outcome Level 1.

Outcome Level 1 - Stormwater Program Activities

SCVURPPP staff routinely updates the Deputy Agricultural Commissioner on water quality issues and MRP requirements. SCVURPPP staff works with Santa Clara County Division of Agriculture staff to conduct outreach to structural Pest Control Professionals. A summary of activities conducted in coordination with the Santa Clara County Division of Agriculture is provided below:

- The Division of Agriculture provided contact information for structural pest control operators registered in Santa Clara County. As described in Section 3.6, SCVURPPP used this list to conduct outreach on IPM.
- Program staff developed articles on pesticide toxicity control which were included in the Santa Clara County Division of Agriculture's "The Pesticide Review" newsletter in November 2016 and November 2018. The Division of Agriculture sent these newsletters to all PCOs registered in Santa Clara County. The newsletters are also available online on the Santa Clara County Division of Agriculture's website at the following links:
 - The Pesticide Review, November 2016
<https://www.sccgov.org/sites/ag/news/Documents/PesticideReview2016.pdf>
 - The Pesticide Review, November 2018
<https://www.sccgov.org/sites/ag/news/Documents/Newsletters/2018PesticideReview.pdf>

3.6. Public Outreach

The goals of the Public Education and Outreach element are to: 1) inform the general public about stormwater pollution due to pesticides, 2) educate them about using IPM techniques for pest control,

and 3) help them choose the least-toxic pesticide. SCVURPPP conducts outreach through its Watershed Watch Campaign, a multi-year, multi-media outreach effort that was launched in 2000 and promotes watershed stewardship by educating the public about watersheds, urban runoff issues and pollution prevention. The Campaign conducts outreach through media advertising, outreach events, school presentations, website, social networking sites, and partnerships with local businesses and community organizations.

SCVURPPP's outreach efforts can be broadly divided into the following categories:

1. **Point-of-Purchase Outreach** – SCVURPPP implements the BASMAA IPM Store Partnership Program (also known as the *Our Water Our World* Program or the OWOW Program) in local retail stores and nurseries. The aim of the OWOW Program is to partner with retail stores and nurseries to provide less-toxic pest control information to residents at the point of purchase. This involves visiting participating stores regularly (at least three times per year) to stock literature racks with “Less-Toxic Pest Management” fact sheets and update “shelf-talkers”. Shelf-talkers are product identification tags that are placed on store shelves to help customers identify less-toxic products. In addition, the Program contracts with an IPM consultant to conduct store employee training. These trainings educate store employees about IPM and selling less-toxic products.
2. **Outreach to Residents** – SCVURPPP conducts a countywide multi-media outreach campaign called the Watershed Watch Campaign (Campaign) to conduct outreach to residents on watershed awareness and stormwater pollution prevention. Messages on IPM, less-toxic pest control, proper disposal of unused pesticides, and hiring an eco-friendly landscape professional or pest control professional are included in the Campaign's media campaign, website and brochures. During the MRP term, the Program has conducted media advertising on IPM using on television, radio, print and online. Advertising is conducted in English and Spanish. Copies of media advertisements are posted at www.MyWatershedWatch.org. In addition, Program and Permittee staff conduct IPM outreach at community events each year.
3. **Outreach to Pest Control Professionals** – SCVURPPP conducts the Santa Clara Valley Green Gardener Program for training landscape maintenance professionals on sustainable landscaping techniques. Each training session consists of ten 2-hour classes, held once a week for ten weeks. Trainings are conducted in English and Spanish. SCVURPPP also conducts targeted outreach to structural PCOs on water quality issues and available IPM-certification programs.

The effectiveness of the SCVURPPP public outreach program and its components is assessed at Outcome Levels 1, 2, 3, and 4. Results of the effectiveness assessment are grouped by outreach program component: 1) Point-of-Purchase Outreach; 2) Outreach to Residents; and 3) Outreach to Pest Control Professionals.

Point-of-Purchase Outreach

Outcome Level 1 - Stormwater Program Activities

SCVURPPP began implementing the OWOW Program locally in FY 98–99. At present, 21 retail stores and nurseries in Santa Clara Valley participate in the OWOW Program.

Each year, SCVURPPP staff visits each store at least three times to stock the literature rack and replace “shelf-talkers”. Training to store employees is also provided. Table 3-3 summarizes employee training information from FY 13-14 to FY 17-18.

Table 3-3 Summary of Store Employees Trained

Fiscal Year	Number of Employees Trained
FY 13-14	100 employees representing 13 stores
FY 14-15	117 employees representing 12 stores
FY 15-16	85 employees representing 10 stores
FY 16-17	95 employees representing 10 stores
FY 17-18	91 employees representing 10 stores

Outcome Level 2: Barriers and Bridges to Action and Outcome Level 3: Target Audience Actions

The employee trainings educate employees on IPM, stormwater pollution problems and how to direct customers toward buying less-toxic products. Since FY 17-18, SCVURPPP has included a pre-training and post-training survey to assess the increase in employee awareness. A total of 91 employees were trained in FY 17-18. The survey responses are provided below, and indicate an increase in awareness:

- 98% of survey respondents said the training will help them recommend and/or sell less-toxic products.
- 82% of survey respondents said that they can comfortably share what they learned with customers and/or co-workers.
- 89% of survey respondents said that they can easily use the Our Water Our World shelf-tags and fact sheets to inform customers about less toxic pest management.
- After the training, 94% of survey respondents said that water entering storm drains does not go to a treatment plant, compared to 82% before the training.
- After the training, 92% of survey respondents said that they think it is more effective to treat an ant infestation with a bait station rather than a spray, compared to 67% before the training.

The willingness of store managers to participate in the OWOW Program and send employees to trainings reflects the changing attitude of pesticide sellers toward IPM and the use of less-toxic pest control methods. Regional OWOW Program leaders report an overall increase in sales of less toxic products as a result of the OWOW Program’s implementation.

Outcome Level 4 Source Contributions

As mentioned above, there is an overall increase in sales of less toxic products as a result of the OWOW Program's implementation. This increase is expected to result in a reduction in the quantity of pesticides of concern being used, and ultimately flowing into storm drains.

Outreach to Residents

Outcome Level 1 - Stormwater Program Activities

SCVURPPP conducts extensive outreach on IPM using media advertising, social media posts, social media advertising, and distribution of outreach materials at events to educate residents about IPM, proper disposal of Household Hazardous Waste, and hiring IPM certified pest control professionals. As an example, in FY 18-19, SCVURPPP conducted the following media advertising on pesticide related topics:

- "Hire a Green Gardener" 30-second radio spots ran in English on KUFX and KBAY; in Spanish on KSOL
- "Hire a Green Gardener" 30-second TV spots ran in English on KNTV; in Spanish on KSTS
- 30-second radio spot "Choose less-toxic DIY methods" ran in English on KUFX and KBAY; in Spanish on KSOL
- 30-second TV spot "Choose less toxic DIY methods" ran in English on KNTV; in Spanish on KSTS
- 15-second radio PSA promoting IPM for pest control ran in English on KUFX, KBLX, KOIT, KMOVQ
- "Pests Bugging You?" digital ads ran on websites for KUFX, KBLX, KOIT, KMOVQ, and were delivered via e-blast to subscribers
- "Pests Bugging You?" targeted digital ads ran in Spanish via CoreAudience on various websites
- "Hire an eco-friendly Pro" 30-second TV ad ran in English on KNTV; in Spanish on KSTS
- "Hire an eco-friendly Pro" 30-second radio spots in English ran on KUFX and KBAY; in Spanish on KSOL
- "Hire an eco-friendly Pro" digital ads ran on websites for KUFX, KBLX, KOIT, KMOVQ
- "Hire an eco-friendly Pro" digital ads were targeted to homeowners on various websites via CoreAudience
- Emails promoting "Hire an eco-friendly Pro" were delivered to subscribers for KUFX and KBAY
- 30-second radio and 15-second PSAs promoting proper disposal of household hazardous waste ran on KUFX, KMOVQ, KBLX and KOIT
- 30-second Spanish radio spots promoting proper disposal of household hazardous waste on KSOL
- Digital ads on proper disposal of household hazardous waste ran KUFX, KMOVQ, KBLX and KOIT station websites and were sent via email blasts to station subscribers

Outcome Level 2: Barriers and Bridges to Action

SCVURPPP’s various efforts to educate residents about IPM and pesticide use and disposal, including media advertising, website postings and distribution of outreach materials at events, raise awareness among residences on IPM and less-toxic pest control. In FY 18-19, media advertising delivered approximately 6,324,831 impressions.

Outcome Level 3: Target Audience Actions

While data are lacking regarding to what extent residents are implementing IPM techniques, data from the Santa Clara County HHW Program indicates that Santa Clara Valley residents continuing to properly dispose of household hazardous wastes, including pesticides. As shown in Table 3-4, from FY 13-14 to FY 17-18, 138,781 residents disposed of household hazardous waste, including unused pesticides, via the Santa Clara County HHW Program. The increase in residents using it in FY 16-17 and FY 17-18 is likely due to the increase in the number of collection events.

Table 3-4 Number of Residents Served by the County HHW Program

Fiscal Year	Number of Residents Served	Number of Collection Events
FY 13-14	23,728	54 collection events: 37 at two permanent facilities and 17 at temporary sites
FY 14-15	25,604	119 collection events: 115 at two permanent facilities and 4 at temporary sites
FY 15-16	26,336	150 collection events: 142 at two permanent facilities and 8 at temporary sites
FY 16-17	28,679	172 collection events: 164 at two permanent facilities and 8 at temporary sites
FY 17-18	34,434	174 collection events: 165 at two permanent facilities and 9 at temporary sites

Outcome Level 4 - Source Contributions

From FY 13-14 through FY 17-18, the Santa Clara County HHW Program collected 884,020 pounds of liquid poisons and 638,692 pounds of solid poisons. If not properly disposed, these HHW materials could lead to urban runoff pollution. Table 3-5 provides a summary by fiscal year.

Table 3-5 Quantity of total poisons (including pesticides) collected at Santa Clara County HHW locations from FY 13-14 to FY 17-18

Year	Quantity of Liquid Poisons Collected (pounds)	Quantity of Solid Poisons Collected (pounds)	Total Quantity of Poisons (Liquid and Solid) Collected	Number of Collection Events	Pounds of Poisons (Liquid and Solid) Collected Annually per Collection Event
FY 13-14	150,070	130,215	280,285	54	5,190
FY 14-15	164,700	122,200	286,900	119	2,410
FY 15-16	173,250	136,957	310,207	150	2,068
FY 16-17	185,450	116,320	301,770	172	1,754
FY 17-18	210,550	133,000	343,550	174	1,974

The increase in the quantity of liquid poisons collected over the years could be attributed to the increase in the number of collection sites.

Outreach to Pest Control Professionals (PCOs)

Outcome Level 1 - Stormwater Program Activities

From FY 13-14 to FY 17-18, SCVURPPP conducted the following activities to educate structural pest control operators and landscape professionals on water quality issues associated with pesticide use and IPM:

- Annually, conducted the Santa Clara Valley Green Gardener Training for landscape professionals. From FY 13-14 to FY 18-19, a total of 108 individuals completed the Basic Green Gardener Training. In addition, 25 individuals completed the Advanced Green Gardener Training.
- Conducted significant outreach via mailings, email, radio ads, the Watershed Watch website, and social networking sites to inform landscape professionals about the availability of the Green Gardener training. For example, media advertising efforts in FY 18-19 included the following:
 - 15-second English radio PSAs promoting becoming a trained Green Gardener ran on KUFX, KBLX, KOIT, KMOV and KBAY
 - “Become a Green Gardener” digital ads ran on websites for KUFX, KBLX, KOIT, KMOV
 - “Become a Green Gardener” digital ads were delivered via station e-blast to subscribers of KUFX, KBLX, KOIT, KMOV
- In FY 14-15, FY 16-17, and FY 17-18, mailed informational letters to all licensed pest control operators in Santa Clara Valley, using the license lookup website for the California Structural Pest Control Board, and the list provided by the Santa Clara County Division of Agriculture. The letters included information on the linkage between the application of pesticides for structural pest control and water quality impacts via stormwater runoff, referencing recent data that shows pesticide related impacts in local creeks. The letters also included a request for businesses to become a certified IPM pest control operator, and to have individual employees become certified if the business is already certified. Copies of the *Less-Toxic Pest Management*

Fact Sheets and the *Less-Toxic Pest Control for Multi-Unit Properties* brochure were included with the letters.

- Only July 12, 2015, presented information on stormwater pollution and pesticides of concerns at the local chapter meeting of the Pest Control Operators of California (PCOC). Approximately 16 pest control professionals representing local structural pest control companies attended the PCOC meeting.
- On February 2, 2016, gave a presentation titled “Reducing Pesticides in Urban Runoff - An Overview of Municipal Activities in Santa Clara Valley” at the Pesticide Applicators Professionals Association (PAPA) seminar held in San Jose. Approximately 140 pest control professionals attended the PAPA seminar.

Outcome Level 2: Barriers and Bridges to Action and Outcome Level 3: Target Audience Actions

Students attending the Santa Clara Green Gardener training are requested to complete a survey at the completion of the training. Highlights of evaluations received in FY 18-19 are provided below:

- 95% of survey respondents indicated that they would change their landscape management practices based on what they have learned in the training.
- 95% of survey respondents indicated that they would recommend this Green Gardener class to a co-worker or another landscape professional.
- 100% of respondents noted that they found the class on IPM useful.

The survey responses indicate an increase in awareness of sustainable landscaping practices and willingness to make changes to landscape management practices based on what was learned at the trainings. In addition to the evaluation, attendees are required to take a final test to receive the certificate of completion. This ensures that they understood the curriculum and will be able to implement the practices at their client locations.

3.7. Minimizing Pesticide Use at New Development and Redevelopment Sites

The goal of this source control measure is to reduce pesticide use by encouraging pest-resistant landscaping and design features in the design, landscaping, and environmental reviews of proposed development projects. This measure is assessed at Outcome Level 1, Level 2, and Level 3.

Outcome Level 1 - Stormwater Program Activities

The SCVURPPP Model Conditions of Approval (COAs) of Development and Redevelopment Projects include measures for incorporating pest resistant landscaping features and practices. Permittees have incorporated these or similar COAs into their project review and approval processes. Beneficial landscaping that minimizes pesticides, fertilizers, irrigation, and runoff is also listed as a Source Control Measure on the SCVURPPP C.3 Data Form that is used (with some modifications) by most permittees.

The Program’s C.3 Stormwater Handbook (April 2016) includes templates for Operation and Maintenance (O & M) of stormwater treatment measures. These templates include guidance on using IPM to maintain these treatment measures. The templates are posted on the Program’s website and

Permittees use the templates as exhibits to their stormwater treatment measure maintenance agreements.

The C.3 Handbook’s Appendix D also includes a list of plants that can be used for stormwater treatment measures, and guidance on planting and maintaining these plants. The recommended plants are non-invasive, California natives that require less water and minimum use of pesticides. The plant list is available on the Program’s website.

Outcome Level 2: Barriers and Bridges to Action

SCVURPPP conducts workshops to educate municipal staff that review development project applications and consultants about the MRP requirements for new and redevelopment projects. Information on Low Impact Development, green streets, landscaping with native plants, and selecting plants for stormwater treatment measures is included in the workshops. This ensures that staff reviewing development projects are familiar with the sustainable landscaping techniques, and encourage developers to include these features in their projects.

Outcome Level 3: Target Audience Actions

Table 3-6 summarizes data from Permittee Annual Reports on the number of regulated projects that incorporate “beneficial landscaping” (landscaping that minimizes pesticides, fertilizers, irrigation, and runoff) as a source control measure.

Table 3-6 Number of Approved Regulated Projects that include Beneficial Landscaping

Year	Number of Regulated Projects Approved by SCVURPPP Permittees	Number of Approved Regulated Projects that Include Beneficial Landscaping	Percentage of Approved Regulated Projects that Include Beneficial Landscaping
FY 13-14	133	61	49%
FY 14-15	113	49	43%
FY 15-16	172	93	54%
FY 16-17	140	83	59%
FY 17-18	129	100	77%

The data indicate that an increasing number of regulated projects are including “beneficial landscaping” (landscaping that minimizes pesticides, fertilizers, irrigation, and runoff) as a source control measure. In FY 2003-14, 49% of the regulated projects included “beneficial landscaping”. This increased to 77% in FY 2017-18. These data suggest that municipal staff that review projects are encouraging project applicants to include beneficial landscaping in their projects. Project applicants and developers are also more willing to incorporate these measures into their landscape plans.

4.0 WATER QUALITY ASSESSMENT (LEVEL 6)

Water quality assessments are conducted using monitoring and assessment data that characterize the quality of discharges from stormwater conveyance systems (Outcome Level 5) or the chemical, physical or biological condition of receiving waters (Outcome Level 6). The available applicable water quality monitoring data in Santa Clara County is generally from receiving waters (i.e., pesticide concentrations and toxicity in water and sediment collected from urban creeks). Collecting useful data from stormwater conveyances is problematic for a number of reasons and as a result these types of data are generally not available. Thus, the effectiveness of source control measures is assessed at Outcome Level 6 (Protecting Receiving Water Quality). The origins of the data used in the Level 6 water quality assessment are described below.

4.1. Pesticide and Toxicity Creek Monitoring Programs in the Santa Clara Valley

Over the course of the past two decades, a number of monitoring programs have tested for pesticides and toxicity in water and sediment from Santa Clara Valley urban creeks:

- SCVURPPP has been the primary monitoring program in the Valley since the late 1990s and continues to collect the largest number of data points in urban creeks, consistent with NPDES municipal stormwater permit requirements. Receiving water monitoring conducted by SCVURPPP includes the monitoring and assessment of indicators of chemical, physical, and biological condition of urban creeks. This includes measuring the concentrations of pesticides in water and sediment from urban creeks and assessing the degree of toxicity to test organisms exposed to water and sediment. See Section 2.4.2 for more details.
- In coordination with SCVURPPP, the Regional Monitoring Program for Water Quality in San Francisco Bay (RMP) Sources, Tributaries, and Loading Strategy (STLS) has analyzed samples collected from Santa Clara Valley creeks for pollutants of concern, including pesticides and related toxicity.
- California's Surface Water Ambient Monitoring Program (SWAMP) has collected pesticide and toxicity data in Santa Clara Valley urban creeks since 2002. These data have been collected through a number of projects implemented at regional and statewide scales, including the Regional Water Board's regional SWAMP program, the State Water Board's Statewide Stream Pollutant Trend (SPoT) program, and a project conducted by the San Francisco Estuary Institute (SFEI) funded through a California Proposition 13 Pesticide Research and Investigation of Source and Mitigation (PRISM) grant (Lowe et al. 2007). The SPoT program's statewide monitoring network includes two bottom-of-the-watershed stations in the Santa Clara Valley that have been sampled nearly every year since 2008.⁷

⁷ https://www.waterboards.ca.gov/water_issues/programs/swamp/spot/

- The California Department of Pesticide Regulation (DPR) has monitored pesticides in water and sediment at stations throughout California since 1991. DPR's monitoring network includes two stations in Santa Clara Valley where water samples have been collected since 2014.
- The concentration of pesticides and extent of toxicity in Bay Area urban creeks were monitored by the Clean Estuary Partnership (CEP) in 2005, including two sites in Santa Clara Valley (Ruby 2005).
- The United States Geological Service (USGS) monitored current-use pesticides and toxicity at urban and agricultural sites throughout California (including one site in Santa Clara Valley - Stevens Creek) from 2015 – 2017 (Sanders et al 2018).

4.2. Pesticides of Concern in Santa Clara Valley Urban Creek Water and Sediment

Each program described above has measured various parameters in water and/or sediment collected from Santa Clara Valley urban creeks. Decisions regarding parameters and sample matrices (i.e., water and/or sediment) are informed by project/program objectives, the chemical characteristics of the pesticides of interest, and available resources. For example, water soluble pesticides such as the organophosphate diazinon (and more recently, the neonicotinoid imidacloprid) are monitored in water samples; whereas, pesticides with a higher affinity to absorb to particles, such as pyrethroids, carbaryl and fipronil are generally measured in creek bedded sediment samples.

Since the early 2000s, the primary focus of pesticide and toxicity monitoring in Santa Clara Valley urban creeks has shifted from the presence and effects of chlorpyrifos, diazinon, and legacy pesticides (e.g., DDT) to pyrethroids and, more recently fipronil. This shift was in response to the declining use of chlorpyrifos and diazinon following the cancellation of these chemicals for residential uses in 2004 and their subsequent replacement with pyrethroids and other newer chemicals.

4.2.1. Concentrations in Water

Table 4-1 summarizes the numbers of water samples collected in Santa Clara Valley urban creeks and analyzed for pesticides from 2002 to 2018. These data were generated from the studies, projects, and programs described in the previous section. During this timeframe, a total of 180 water samples collected from various sites in urban creeks were analyzed for pesticides. Samples were collected during both storm events and dry weather conditions.

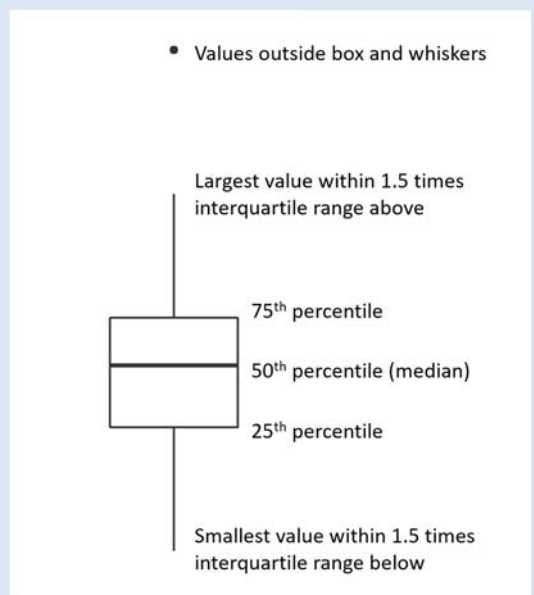
Table 4-1. Number of water samples collected from Santa Clara Valley urban creeks and analyzed for pesticides from 2002 to 2018.

Monitoring Program	Data Points Collected in Santa Clara Valley Urban Creeks per Year																
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
SCVURPPP Monitoring Program																	
Pre-MRP Monitoring	7	20	23	19	11	8	6	-	-	-	-	-	-	-	-	-	-
BASMAA RMC Monitoring (MRP)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
POC Loads Monitoring (with the RMP STLS)	8	17	4	-	-	-	-	-	-	-	9	2	9	-	-	-	-
Surface Water Ambient Monitoring Program (SWAMP)																	
Region 2 (SF Bay Region) Monitoring	6	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Statewide Stream Pollution Trends (SPoT) Program	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PRISM Grant Program	-	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Clean Estuary Partnership (CEP)																	
Urban Pesticide Monitoring Project	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Department of Pesticide Regulation (DPR)																	
Surface Water Monitoring Project	-	-	-	-	-	-	-	-	-	-	-	-	4	4	1	2	2
United States Geological Service (USGS)																	
Current-Use Pesticides (Data Series 1088)	-	-	-	-	-	-	-	-	-	-	-	-	-	1	3	2	-
Totals	21	40	29	23	11	8	6	0	0	0	9	2	13	5	4	4	5

Figure 4-1 compares concentrations of diazinon in these Santa Clara Valley urban creek water samples (2002 – 2018) to the diazinon concentration target described in the TMDL/WQAS for diazinon and pesticide-related toxicity in San Francisco Bay area urban creeks (SFRBWQCB 2005). The data indicate that diazinon concentrations were well below the TMDL/WQAS target. As described previously, in 2000 USEPA announced an agreement with pesticide manufacturers to remove most products containing diazinon and chlorpyrifos from retail store shelves and end most residential and professional uses by the end of 2004. Diazinon concentrations dropped quickly after this date.

Explanation of Box and Whisker Plots

Figures 4-1 through 4-4 present data in “box and whisker” plots. These plots help visualize the distribution of the data and provide a simple way to compare groups of data, such as all data collected within a given year. Box and whisker plots show the 50th percentile (median), 25th percentile, 75th percentile, largest value within 1.5 times the interquartile range above the 75th percentile, smallest value within 1.5 times the interquartile range below the 25th percentile, and outliers above and below these values.



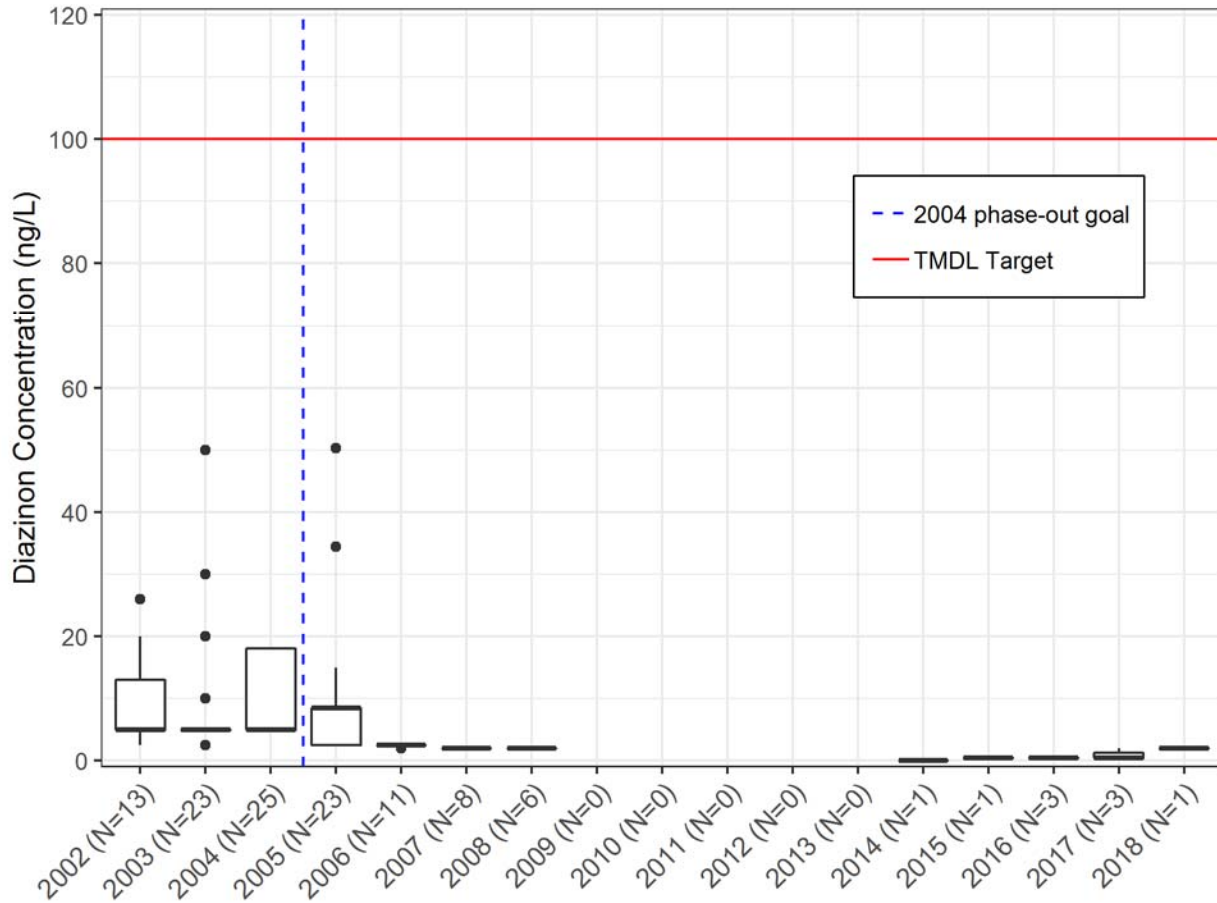


Figure 4-1 Diazinon concentrations in water samples collected from Santa Clara County urban creeks from 2002 to 2012 . Redline is the TMDL target for diazinon (SFRBWQCB 2005). Note: concentrations reported as non-detect (ND) are plotted as ½ method detection limit (MDL) (0.0025 – 0.015 ug/L).

Imidacloprid is a neonicotinoid pesticide that has rapidly become commonly used in recent years for indoor and outdoor pest control, pet treatments, and in construction materials. A total of 13 water samples from Santa Clara Valley urban creeks have been analyzed for imidacloprid since 2014: three by SCVURPPP during a single 2018 storm event, four by DPR during dry weather, and six by the USGS during both dry weather and storm events. Imidacloprid was detected in just one of the 13 samples. On June 8, 2016 imidacloprid was detected by the USGS at a concentration of 0.037 µg/L in Stevens Creek (Sanders et al. 2018). This concentration exceeds the USEPA proposed chronic exposure benchmark for aquatic insects in freshwater of 0.01 µg/L but not the acute exposure benchmark of 0.385 µg/L, nor the current acute and chronic invertebrate benchmarks of 34.5 and 1.05 µg/L, respectively (USEPA 2017). The presence of neonicotinoids is of concern due to their persistence in the environment and potential consequences for non-target insect pollinators.

4.2.2. Concentrations in Sediment

Table 4-2 summarizes the numbers of bedded sediment samples collected in Santa Clara Valley urban creeks and analyzed for pesticides from 2002 to 2018. These data were generated by the programs

described in Section 4.1; however, the primary data sources include the SPoT Program which has sampled Coyote Creek and Guadalupe River nearly every year since 2008, and SCVURPPP which has sampled urban creeks throughout the County since 2012 per MRP monitoring requirements (see Section 2.4.2 for a description of MRP monitoring requirements). During this timeframe, a total of 105 sediment samples collected from various sites in urban creeks were analyzed for concentrations of pyrethroids and other current use or emerging pesticides (such as fipronil). All bedded sediment samples were collected during dry weather conditions.

Table 4-2. Number of bedded sediment samples collected from Santa Clara County urban creeks and analyzed for pesticides from 2002 to 2018

Monitoring Program	Data Points Collected in Santa Clara Valley Urban Creeks per Year																
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
SCVURPPP Monitoring Program																	
Pre-MRP Monitoring	4	3	-	-	12	17	16	-	-	-	-	-	-	-	-	-	-
BASMAA RMC Monitoring (MRP)	-	-	-	-	-	-	-	-	-	-	3	3	3	3	4	2	7
POC Loads Monitoring (with the RMP STLS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Surface Water Ambient Monitoring Program (SWAMP)																	
Region 2 (SF Bay Region) Monitoring	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Statewide Stream Pollution Trends (SPoT) Program	-	-	-	-	-	-	2	1	2	2	2	2	2	2	2	2	2
PRISM Grant Program	-	-	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Clean Estuary Partnership (CEP)																	
Urban Pesticide Monitoring Project	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-
Department of Pesticide Regulation (DPR)																	
Surface Water Monitoring Project	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
United States Geological Service (USGS)																	
Current-Use Pesticides (Data Series 1088)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals	6	3	1	2	12	19	18	1	2	2	5	5	5	5	6	4	9

Figures 4-2 through 4-4 compare concentrations of commonly detected pyrethroids in Santa Clara Valley urban creek sediment samples to adverse effects LC₅₀ thresholds⁸ identified in the literature (Amweg et al. 2005, Maund et al. 2002, Weston et al. 2013). Figures 4-5 and 4-6 compare concentrations of two degradates of the non-pyrethroid pesticide fipronil to adverse effects thresholds proposed by Maul et al. (2008). Data presented are normalized to total organic carbon (TOC) since pyrethroids and fipronil are found primarily in the organic carbon fraction of sediments and because the LC₅₀ thresholds are given as TOC-normalized concentrations. Only those data with values measured above method detection limits are presented in the figures.

Based on the sediment data compiled, it appears that pyrethroid concentrations in sediment have decreased since 2011/2012. These trends are relatively clear in the datasets for Coyote Creek at Montague (station 205COY060) and Guadalupe River at USGS gaging station 11169025 (station 205GUA020) which have been sampled nearly every year since 2008 by the SPoT program. Samples from these stations are shown in Figures 2 through 6. Although the other stations provide a wider geographic resolution to the Santa Clara Valley dataset, none has been sampled more than two or three times, and therefore are less informative of long-term trends.

Pyrethroid concentrations in the dataset rarely exceed the adverse effects thresholds after 2013. The only exception is one sample collected by SCVURPPP in Upper Penitencia Creek (below Piedmont Rd) on May 5, 2016 with a TOC-normalized concentration exceeding the bifenthrin LC₅₀ (Figure 2). Bifenthrin is considered to be the leading cause of pyrethroid-related toxicity in urban areas (Ruby 2013).

In recent years, many applicators have switched from pyrethroids to the non-pyrethroid pesticide fipronil to control insects (such as ants and termites) in urban areas. Although fipronil has not been measured above the detection limit in Santa Clara Valley urban stream sediments, some of its stable degradates have been observed. Fipronil sulfide and fipronil sulfone concentrations (normalized to TOC) are plotted in Figures 5 and 6 with the adverse effects thresholds proposed by Maul et al. (2008) shown for comparison. All TOC-normalized concentrations are well below the proposed thresholds.

⁸Lethal Concentration 50% - the dose required to kill half the members of a tested population after a specified test duration.

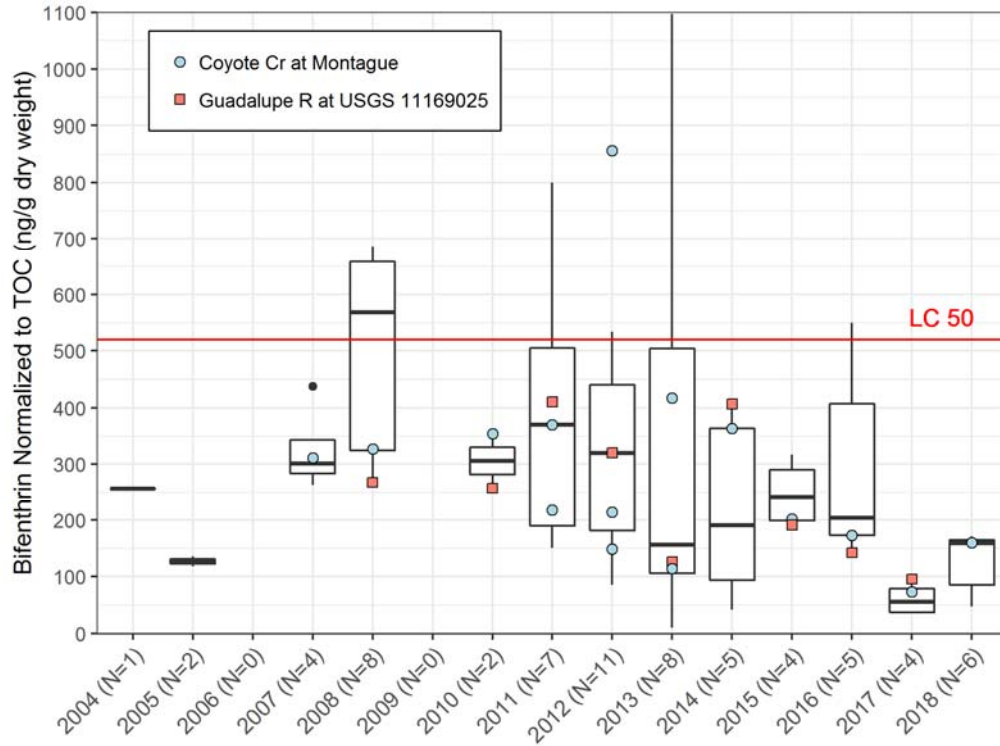


Figure 4-2. Bifenthrin concentrations in bedded sediment collected from Santa Clara Valley urban creeks from 2004 to 2018. Red line is the adverse effects concentration (i.e., LC₅₀) for *Hyaella azteca* (Amweg et al. 2005). Only samples with concentrations above the detection limit are included

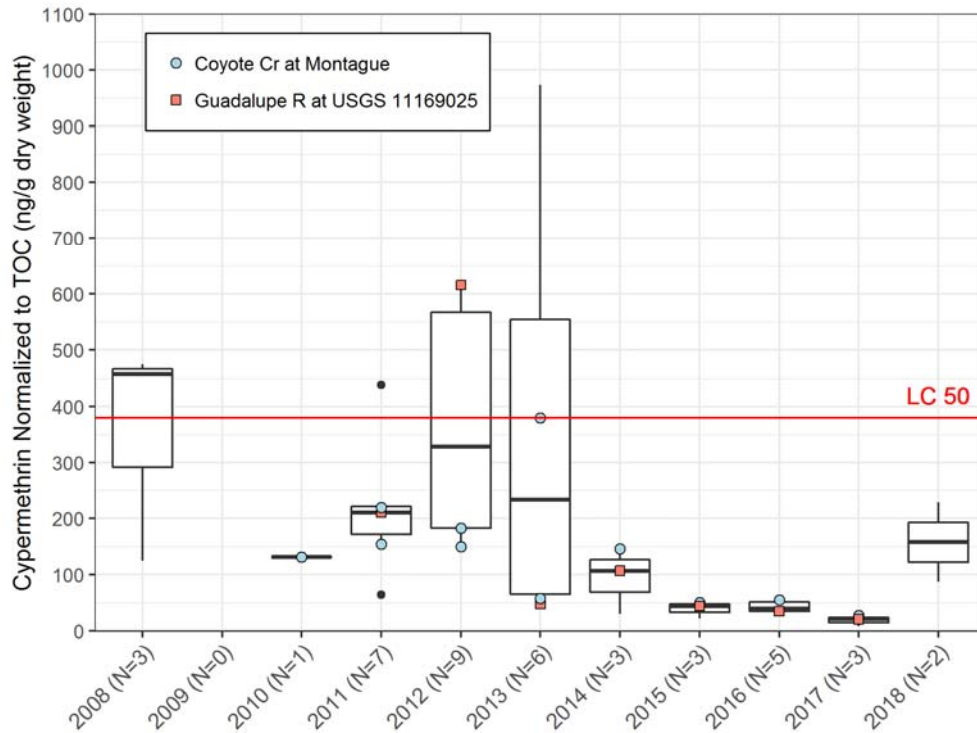


Figure 4-3 Cypermethrin concentrations in bedded sediment collected from Santa Clara Valley urban creeks from 2008 to 2018. Red line is the adverse effects concentration (i.e., LC₅₀) for *Hyaella azteca* (Weston et al. 2013). Only samples with concentrations above the detection limit are included.

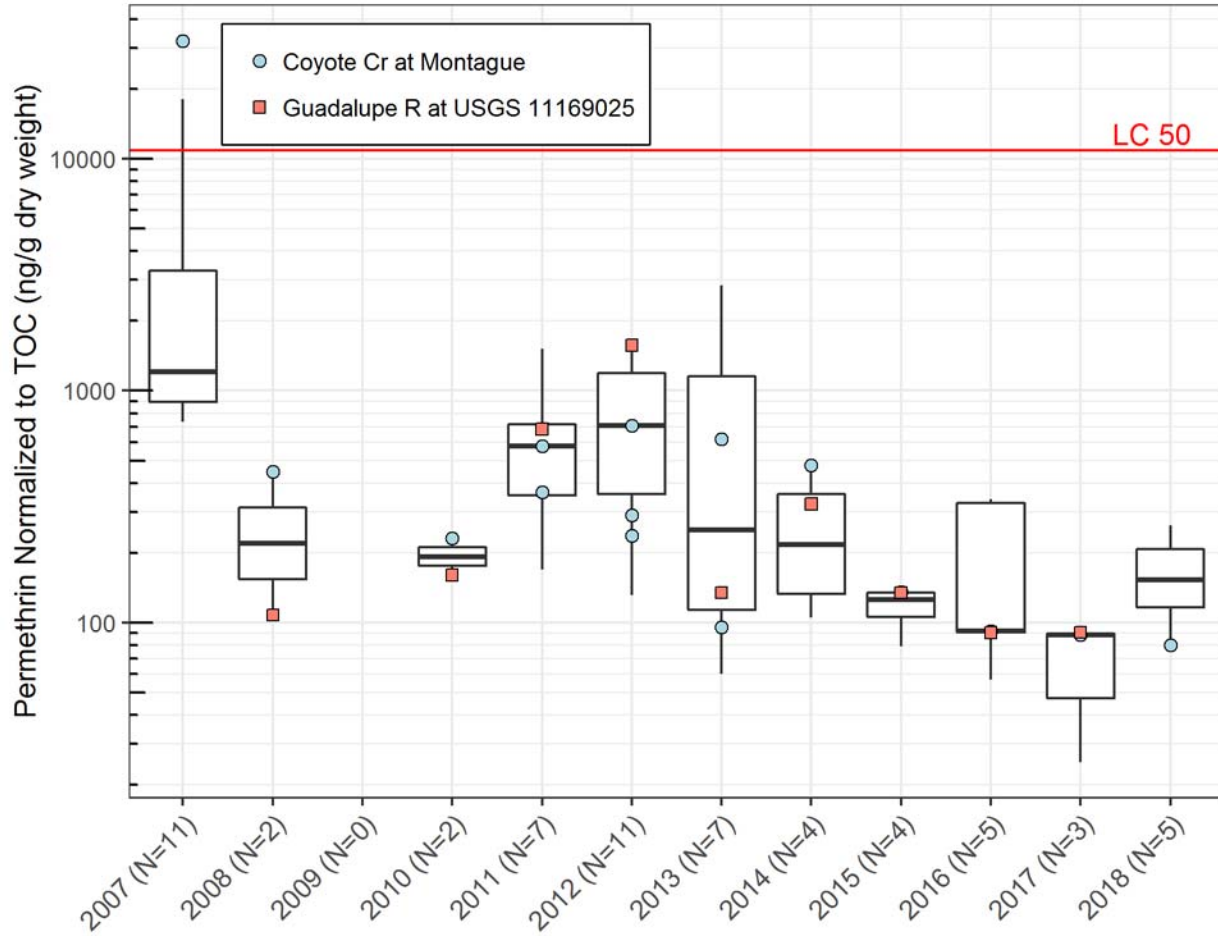


Figure 4-4 Permethrin concentrations in bedded sediment collected from Santa Clara Valley urban creeks from 2002 to 2018. Red line is the adverse effects concentration (i.e., LC₅₀) for *Hyalella azteca* (Amweg et al. 2005). Only samples with concentrations above the detection limit are included. Note the x-axis is on a log scale.

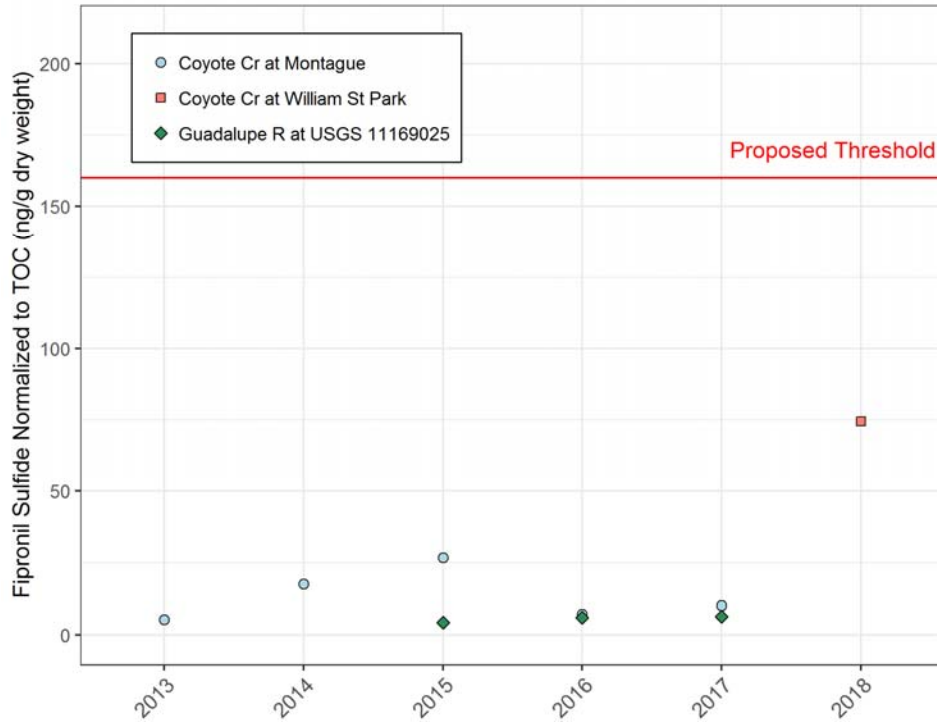


Figure 4-5 Fipronil sulfide concentrations in bedded sediment collected from Santa Clara Valley urban creeks from 2013 to 2018. Red line is the proposed adverse effects threshold (i.e., LC₅₀) for *Chironomus tentans* (Maul et al. 2008). Only samples with concentrations above the detection limit are included.

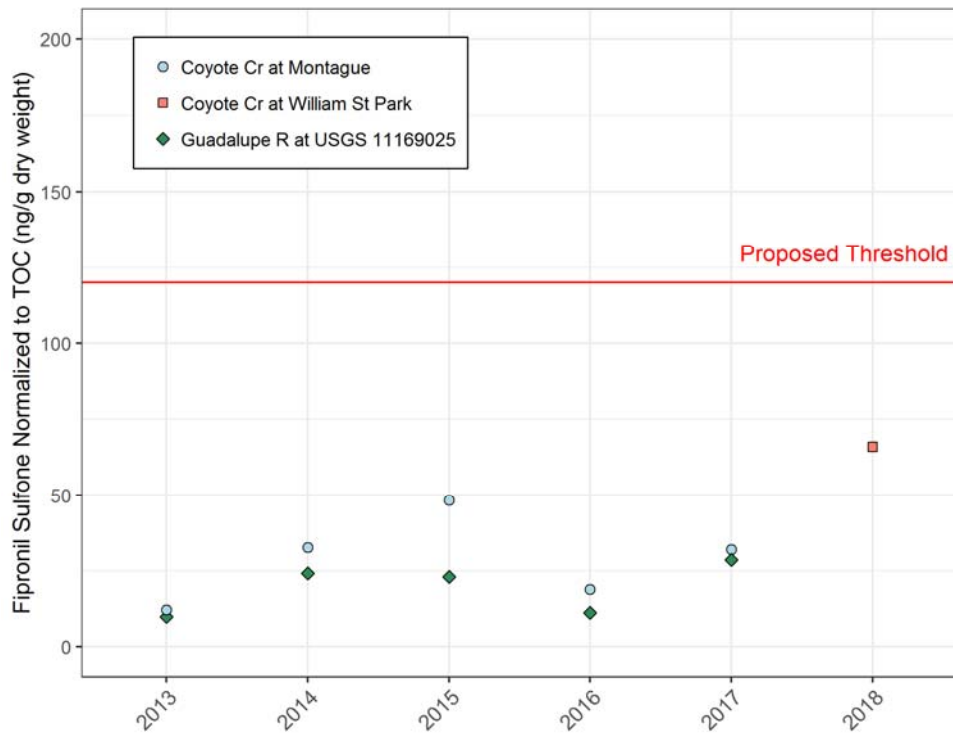


Figure 4-6 Fipronil sulfone concentrations in bedded sediment collected from Santa Clara Valley urban creeks from 2013 to 2018. Red line is the proposed adverse effects threshold (i.e., LC₅₀) for *Chironomus tentans* (Maul et al. 2008). Only samples with concentrations above the detection limit are included.

4.3. Toxicity in Santa Clara Valley Urban Creek Water and Sediments

The types of test organisms used in toxicity testing differ between water and sediment and responses vary with exposure to different pesticides. Test organisms *Ceriodaphnia dubia* (a crustacean), *Hyalella azteca* (an amphipod), *Pimephales promelas* (fathead minnow), and *Selenastrum capricornutum* (a green algae) are typically utilized for testing for acute and chronic toxicity in the water column. *Ceriodaphnia dubia* is highly sensitive to diazinon. *Hyalella azteca* and *Chironomus dilutus* are typically the only organisms used to evaluate toxicity in sediments from freshwater creeks. *H. azteca* is highly sensitive to pyrethroid pesticides. *Chironomus dilutus* (a midge) is sensitive to fipronil, its degradates, and neonicotinoids (i.e., imidacloprid); it was added to the SPoT program in 2015 and to MRP monitoring in 2016.

A two-tiered approach is typically applied to determine toxicity. First, organism responses from ambient samples are compared to responses from appropriate control samples using a statistical comparison. This is followed by a comparison to a “threshold value” that indicate the magnitude of the difference in response. The SWAMP database applies a threshold value of 20 percent. Both criteria must be met for a sample to be considered toxic.

4.3.1. Toxicity in Water

Table 4-3 summarizes the numbers of water samples collected in Santa Clara Valley urban creeks and tested for toxicity to laboratory test organisms between 2002 and 2018. These data were generated by the programs described in Section 4.1. Water samples for toxicity testing are collected in dry and wet weather conditions.

Figure 4-7 shows that toxicity (assessed by the two-tiered approach) to *Ceriodaphnia dubia* has not been observed in water samples collected from Santa Clara Valley urban creeks since 2005. These results correspond to the timeframe when diazinon and chlorpyrifos were phased out of use in urban areas and support the hypothesis that *Ceriodaphnia dubia* toxicity exhibited in the 1990s was attributable to these organophosphate pesticide.

Toxicity tests in water using *Chironomus dilutus* (which is sensitive to neonicotinoids) was conducted by SCVURPPP in 2016 – 2018 on a total of nine samples. While none of samples exceeded the MRP evaluation threshold of 50 percent, two of the samples did show acute toxicity using the SWAMP evaluation threshold value of 20 percent. Both of the acutely toxic samples were collected at station 205STE021 in Stevens Creek: one on July 11, 2016 with a 30 percent effect and the other on July 17, 2018 with a 24 percent effect. It is likely that the toxicity to *Chironomus dilutus* was caused by imidacloprid or another neonicotinoid. Imidacloprid was detected in Stevens Creek by the USGS on June 8, 2016 at a concentration of 0.037 µg/L (Sanders et al. 2018).

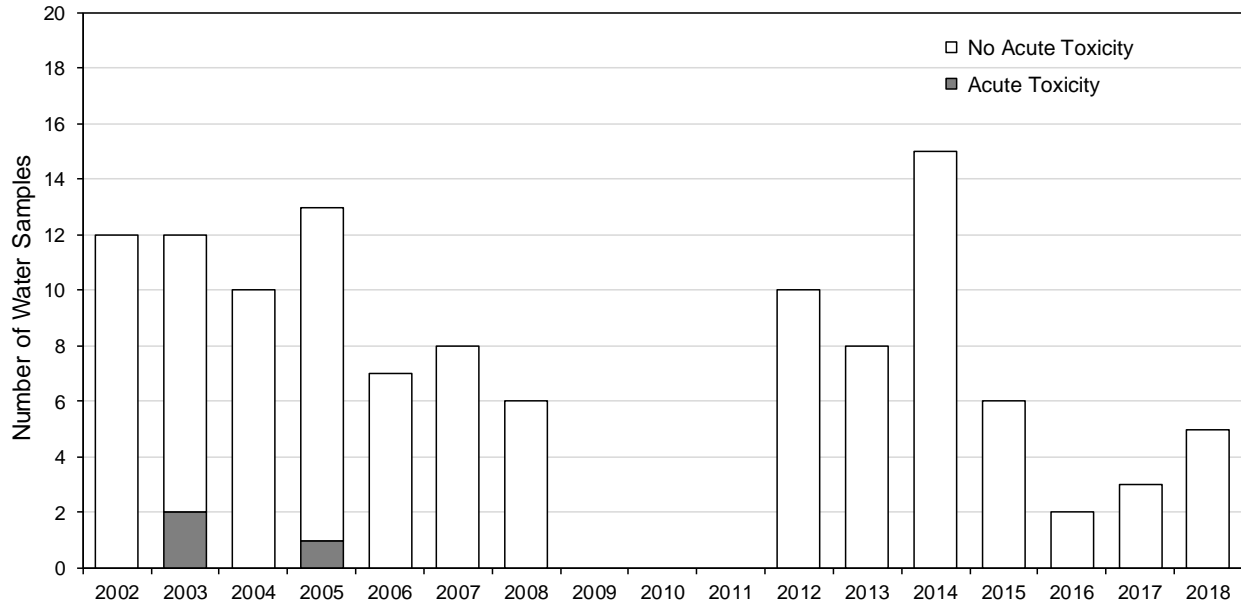


Figure 4-7 Numbers of water samples collected from Santa Clara Valley urban creeks from 2002 to 2016 that exhibited acute toxicity to *Ceriodaphnia dubia*, a test organism sensitive to diazinon.

Table 4-3. Number of water samples collected from Santa Clara Valley urban creeks and analyzed for toxicity from 2002 to 2018.

Monitoring Program	Data Points Collected in Santa Clara Valley Urban Creeks per Year																
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
SCVURPPP Monitoring Program																	
Pre-MRP Monitoring	4	8	10	11	7	8	6	-	-	-	-	-	-	-	-	-	-
BASMAA RMC Monitoring (MRP)	-	-	-	-	-	-	-	-	-	-	6	6	6	6	2	3	5
POC Loads Monitoring (with the RMP STLS)	-	-	-	-	-	-	-	-	-	-	4	2	9	-	-	-	-
Surface Water Ambient Monitoring Program (SWAMP)																	
Region 2 (SF Bay Region) Monitoring	8	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Statewide Stream Pollution Trends (SPoT) Program	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PRISM Grant Program	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Clean Estuary Partnership (CEP)																	
Urban Pesticide Monitoring Project	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Department of Pesticide Regulation (DPR)																	
Surface Water Monitoring Project	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
United States Geological Service (USGS)																	
Current-Use Pesticides (Data Series 1088)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals	12	12	10	13	7	8	6	0	0	0	10	8	15	6	2	3	5

4.3.2. Toxicity in Sediment

Table 4-4 summarizes the numbers of sediment samples collected in Santa Clara Valley urban creeks and tested for toxicity to laboratory test organisms from 2002 to 2018. These data were generated by the programs described in Section 4.1.

Figure 4-8 illustrates the number of bedded sediment samples collected from Santa Clara Valley urban creeks from 2002 to 2018 that were considered toxic to the test organism *Hyalella azteca* using the two-tiered approach. In 2011 and 2013-2016, the SPoT program analyzed sediment samples for *Hyalella azteca* toxicity using two different temperature treatments: the standard 25°C and 15°C, which may be more representative of creek conditions and often results in higher toxicity to *Hyalella azteca*. Both results are included in Figure 8; 16 of the 52 acute toxicity findings are from the samples tested with the lower temperature treatment. Over half of the same samples did not exhibit toxicity using the standard temperature method. Based on the results shown in Figure 9, it appears that sediment toxicity to *Hyalella azteca* has decreased since 2012.

Results from a total of 21 toxicity tests in sediment using *Chironomus dilutus* and *Chironomus tentans*, test organisms sensitive to neonicotinoids, conducted by SCVURPPP in 2016 – 2018 and the SPoT program in 2015 - 2018 did not show acute toxicity using the two-tiered approach.

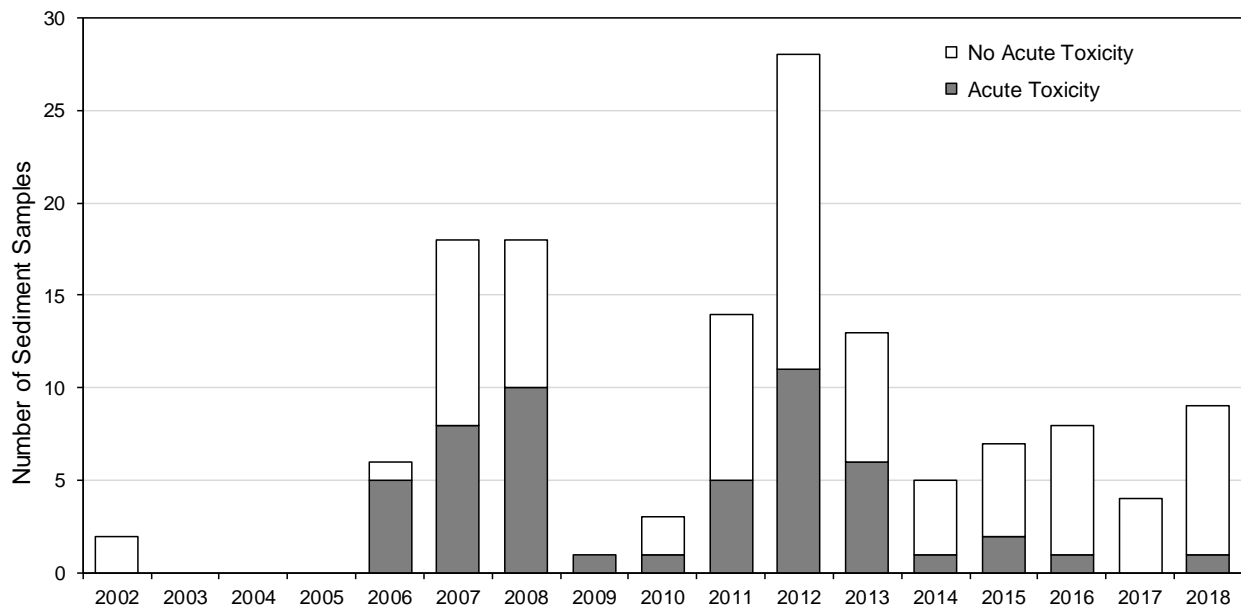


Figure 4-8 Sediment samples collected from Santa Clara Valley urban creeks from 2002 to 2018 that exhibited significant acute toxic to *Hyalella azteca*, a test organism sensitive to pyrethroid pesticides.

Table 4-4. Number of sediment samples collected from Santa Clara Valley urban creeks and analyzed for toxicity from 2002 to 2018.

Monitoring Program	Data Points Collected in Santa Clara Valley Urban Creeks per Year																
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
SCVURPPP Monitoring Program																	
Pre-MRP Monitoring	-	-	-	-	6	15	16	-	-	-	-	-	-	-	-	-	-
BASMAA RMC Monitoring (MRP)	-	-	-	-	-	-	-	-	-	-	3	3	3	3	4	2	7
POC Loads Monitoring (with the RMP STLS)	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-
Surface Water Ambient Monitoring Program (SWAMP)																	
Region 2 (SF Bay Region) Monitoring	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Statewide Stream Pollution Trends (SPoT) Program ¹	-	-	-	-	-	-	2	1	2	7	10	5	2	2	2	2	2
PRISM Grant Program	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Clean Estuary Partnership (CEP)																	
Urban Pesticide Monitoring Project	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-
Department of Pesticide Regulation (DPR)																	
Surface Water Monitoring Project	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
United States Geological Service (USGS)																	
Current-Use Pesticides (Data Series 1088)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals	2	0	0	0	6	18	18	1	2	7	18	8	5	5	6	2	9

¹ In 2011 and 2013-2016, the SPoT program conducted *Hyalella azteca* testing at standard temperature (°25 C) and at the alternative temperature of °15 C which may be more representative of creek conditions and often results in higher toxicity to test organisms. Both results are included in Figure 8.

4.4. Statewide Review of Pesticide and Toxicity Monitoring Data

Ruby (2013) compiles and summarizes chemistry data from monitoring performed in urban areas of California (including the San Francisco Bay area) for pyrethroid and fipronil pesticides and related toxicity testing results, covering the ten-year period from 2003 to 2012 (Ruby 2013). Over 9,200 pyrethroid sample analysis results and 3,200 fipronil results were evaluated and summarized along with a large amount of toxicity testing data. The author concluded that evidence of the presence and effects of pyrethroids and fipronil, and associated toxic effects in urban watercourses, is widely distributed geographically throughout urbanized areas of California. Furthermore, the author found that pyrethroid-related toxicity has been documented in nearly every major urban watershed in the state.

Other studies that quantify pesticide concentrations in water can provide a perspective with which to review the results of the pesticide monitoring conducted in the Santa Clara Valley. The California DPR routinely conducts pesticide monitoring at MS4 and receiving water sites in both Northern and Southern California with the objectives of evaluating pesticide concentrations in water, frequencies with which individual pesticide compounds are detected, and exceedances of US PA pesticide benchmarks. In WY 2017 (i.e., October 1, 2016 through September 30, 2017), DPR monitored locations in Alameda, Contra Costa, Placer, Sacramento, and Santa Clara Counties in Northern California as well as locations in Los Angeles, Orange, and San Diego Counties in Southern California. The pesticide analytes sampled by DPR were similar to those sampled by SCVURPPP in compliance with the MRP and are included in the data evaluation presented above in Sections 4.2 and 4.3.

In the Northern California DPR study, bifenthrin had a detection frequency (DF) of 74%, making it the most frequently detected insecticide. Other pyrethroids sampled during the study were either not detected at all or had significantly lower DF values than bifenthrin. Imidacloprid was the second-most frequently detected insecticide with a DF of 59%. Fipronil, with a DF of 50%, was the third-most frequently detected insecticide. Fipronil degradates, fipronil desulfinyl and fipronil sulfone were also detected at rates of 56% and 21%, respectively. Pyrethroid concentrations were generally above their USEPA minimum benchmarks for toxicity to aquatic life with the exception of cyfluthrin, which is generally detected below the USEPA toxicity benchmark. Concentrations of imidacloprid and fipronil were always above their minimum benchmarks when detected by the DPR Surface Water Protection Program (SWPP). The fipronil degradates were not above their minimum benchmarks except for one fipronil sulfone sample. (Ensminger 2017)

In the Southern California DPR study, bifenthrin was the most frequently detected pyrethroid insecticide with a DF of 79%. The other sampled pyrethroids were again either not detected at all or detected significantly less frequently than bifenthrin. Fipronil also had a DF of 79%, and several of its degradates including fipronil sulfone and fipronil desulfinyl were also detected at comparably high concentrations (72 and 70%, respectively). Imidacloprid was the most frequently detected pesticide at a rate of 81%. (Budd 2018).

5.0 Permittee Specific Improvements and Enhancements

As described in Section 3.0 of this report, Permittees have been implementing pesticide toxicity control programs since 2003. The sections below summarize the improvements to IPM programs made by Permittees in the preceding five years, and enhancements that are planned in the subsequent permit term.

5.1. City of Campbell

Improvements to IPM Practices in the Last Five Years

The City of Campbell used to spray herbicides on bare ground to remove weeds in recreational areas. To create pesticide-free parks, the City now places three inches of mulch over bare areas. In addition, the City replaced cool-season grasses with warm-season Bermuda grass in athletic fields and converted a number of large areas from turf to a xeriscape. The aggressive growth and drought tolerance of the warm-season grass does not allow weeds to germinate. All of the City's park maintenance staff completed the Bay-Friendly Training which includes thorough training on IPM practices.

Enhancements to IPM Practices Planned for the Next Permit Term

In the next permit term, the City of Campbell plans to expand the practice of mulching bare ground in areas outside of parks to eliminate the use of pesticides at more sites. The City also plans to enhance staff trainings with information on IPM, use microorganisms to improve soil health, and capture and relocate honey bees instead of killing them.

5.2. City of Cupertino

Improvements to IPM Practices in the Last Five Years

The City of Cupertino annually evaluated IPM practices, and incorporated improvements or new methods. For example, the City increased use of mulch as weed inhibitor, transitioned to drought-tolerant landscaping, used drip irrigation to curtail excessive watering of flower beds, trimmed back vegetation to curb Argentine ants, and removed fungus infected tree limbs to halt spread of disease. The City utilizes volunteers to assist in manual removal of invasive species.

The City began using the SCVURPPP Pesticide Tracking Excel Workbook to improve pesticide tracking. The City supported employees' attendance in IPM seminars at numerous conferences and online courses. At the City's annual IPM training, all participants discuss the trainings they have received, and bring new ideas to the table for implementation in the field.

Enhancements to IPM Practices Planned for the Next Permit Term

City staff performing landscape and tree maintenance are committed to continually expanding use of IPM methods and enhancing staff training. Through continued exposure to IPM seminars and knowledge gained from field trials, City staff plan on annual incremental improvements in IPM practices.

5.3. City of Los Altos

Improvements to IPM Practices in the Last Five Years

The City's IPM procedures were updated in 2017 to include the practice of mulching bare ground areas, and replacing turf with drought tolerant, low water need plants. In 2016, the City employed successful IPM practices from the City's orchards to create pesticide-free parks. These included replacing sprays with baits and traps, mulching, planting open areas with ground covers, and mechanical removal of weeds. Preventative practices employed included improved sanitation, and replacement of plants that required frequent pesticide application with native plants.

Enhancements to IPM Practices Planned for the Next Permit Term

The City plans to add effective rodent control practices to its IPM Policy and Standard Operating Procedures, and enforce trapping of rodents in buildings and parks. Los Altos also plans to expand the practice of mulching bare ground areas and the use of drought tolerant plants in the City's median strips. The City plans to increase supervision of contractors to ensure compliance with its IPM Policy.

5.4. Town of Los Altos Hills

Improvements to IPM Practices in the Last Five Years

The Town of Los Altos Hills monitored weeds and used manual removal and mulch for weed abatement. The Town aimed to use non-chemical strategies, and when a pest threshold was exceeded, used species-targeted pesticides rather than broadcast spray methods.

Enhancements to IPM Practices Planned for the Next Permit Term

In mid-2020, the Town plans to begin an update of its IPM Policy to include enhanced staff training on IPM. The Town plans to readopt the Policy by Council in the next permit term.

5.5. Town of Los Gatos

Improvements to IPM Practices in the Last Five Years

The Town of Los Gatos updated its Standard Operating Procedures for contractors managing pest control in the Town. The Town no longer sprays swarming bees and wasps, and instead relocates hives and traps wasps. In addition, the Town employs prevention practices such as careful sanitation and visual inspections. For example, picnic tables are washed regularly, trash cans are emptied frequently, and potential nesting sites in trees are closed with caulk. The Town also added IPM training to routine tailgate safety meetings.

Enhancements to IPM Practices Planned for the Next Permit Term

In the next permit term, the Town plans to continue the reduction of pesticides in parks and buildings through increased use of mechanical removal of pest vegetation and building pests. The Town plans to discontinue using pesticides on roadsides and public right-of-ways.

5.6. City of Milpitas

Improvements to IPM Practices in the Last Five Years

The City of Milpitas updated its SOPs in 2017 to include practices suggested by a contracted Pesticide Control Advisor (PCA). Staff regularly utilize non-chemical strategies such as monitoring, mowing weeds, mulching. The City also began requiring all contractors to submit monthly pest management reports. City staff also employ IPM practices for addressing pests; for example, a contractor was brought in to safely vacuum and relocate beehives on City property or right-of-ways. Additionally, the City identified opportunities for removing turf and replacing with native, drought tolerant plants including establishing a demonstration garden at the City's Fire Station 1. As an incentive to encourage staff training and on-going education, the City began offering a 4% pay increase to employees that have obtained a Qualified Applicator Certification (QAC) or Qualified Applicator License (QAL).

Enhancements to IPM Practices Planned for the Next Permit Term

City staff plans to review overall IPM implementation and identify areas for improvement in staff trainings and hiring practices for contractors that apply pesticides, and also plans to increase supervision of contractors. During the first two years of the next permit term, staff plans to review the City's IPM policies and practices and identify an action plan to implement improvements. City staff also plans to continue to look for more opportunities to replace turf with native, drought tolerant plantings.

5.7. City of Monte Sereno

Improvements to IPM Practices in the Last Five Years

The City of Monte Sereno implemented trapping of pests when necessary (e.g., gophers, flies), regular monitoring of pests, and use of an IPM-certified pest control contractor. The City removed turf in FY 2017/18 from the small landscaped area in front of City Hall, and installed drought-tolerant California native plants, which are more pest resistant.

Enhancements to IPM Practices Planned for the Next Permit Term

In the first half of the subsequent permit term, City staff plans to work with the West Valley Clean Water Program Authority to conduct IPM outreach to Monte Sereno residents.

5.8. City of Mountain View

Improvements to IPM Practices in the Last Five Years

The City of Mountain View has not used pesticides in parks in the last three years. To deter pests, the City used mulch and other practices that promoted the health of landscaping. The City started using organic products for weed control in parks and public facilities, but found the products unpredictable and not very effective in the cooler months. For a recent tussock moth outbreak, the City chose to only treat trees in high impact areas and used the least toxic effective product.

The City required all staff who apply pesticides to obtain and maintain the Qualified Applicator Certification (QAC). The process ensures that City staff receive IPM training through the required

continuing education. The City also provided annual trainings on IPM principals for staff. In FY 2015/16, the City revised the golf course contractor's agreement to ensure adherence to the City's IPM Policy.

Enhancements to IPM Practices Planned for the Next Permit Term

The City plans to evaluate the alternative organic products being used for weed control, and create guidelines for product selection. The City also plans to develop a program that incorporates pre-emergent herbicides and other products for the cooler months when organic products are not very effective.

The City plans to update its IPM Policy to include the use of organic products in medians and other area not presently pesticide free.

5.9. City of Palo Alto

Improvements to IPM Practices in the Last Five Years

The City of Palo Alto is in the midst of revising its IPM Policy and plans to have an updated Policy by June 2020. The City established 21 pesticide-free parks and facilities with mulch, replacement of plants that require frequent pesticide applications with native plants, baits and traps, removal of wasp nests instead of broadcast sprays, installation of door sweeps, and improved sanitation. The City updated its pesticide tracking system, though still sees room for improvement. The City established criteria for hiring and supervising contractors who may apply pesticides. Staff conducted spot checks, maintained ongoing communication and required contractors to provide annual reports on their IPM applications. Starting in 2016, City staff shadowed contractors to ensure the City's IPM Policies were followed. The City enhanced outreach to residents about pesticides as part of its annual outreach plan.

Enhancements to IPM Practices Planned for the Next Permit Term

The current pesticide tracking system is complicated, and the city plans to develop a new system during the next permit term. The City also plans to enhance its outreach to residents regarding IPM practices.

5.10. City of San Jose

Improvements to IPM Practices in the Last Five Years

The City of San Jose refined and expanded functions of its pesticide data entry and tracking portal for streamlining pesticide analysis and verifying the use of alternative treatments and IPM methods. The data entry portal is used by both City staff and external vendors.

The City continued with adaptation of an ongoing rodent management pilot to monitor and evaluate thresholds and appropriate best methods including limited use of Fumitoxin (phosphine gas), trapping, and Burrow-X (carbon monoxide smoke) to control ground squirrel and rodent populations. To help control small rodent populations naturally, the City used nest boxes to attract Barn owls to 13 City parks, two community gardens, a public high school, and the San José - Santa Clara Regional Wastewater Facility.

The City extended sustainable landscape retrofit efforts to five City Fire Stations and one public high school that now serve as sustainable landscaping demonstration areas for workshops and outreach events.

The City conducted outreach to professional pesticide applicators regarding non-toxic rodent management through the ReScape Qualified Maintenance Professional program, and presented information on sustainable landscaping basics to Groundworkers and Maintenance Assistants through a training pilot program.

Enhancements to IPM Practices Planned for the Next Permit Term

The City's IPM SOPs and BMPs are contained in a living document that can be updated, as needed, to improve communication of new or changing IPM methods. The City plans to review the SOPs and BMPs to determine if enhancements to the document are needed. The pesticides tracking system may also be reviewed depending on revisions to City SOPs, BMPs, policies, and/or changes to federal list of banned pesticides. The Review of the SOPs and tracking system is planned for the first to second year of the next permit term.

5.11. City of Santa Clara

Improvements to IPM Practices in the Last Five Years

The City of Santa Clara updated its IPM policy to prohibit the use of products containing anticoagulants on City property. The City developed landscape plans that incorporated native plants, mulch in tree wells, and sheet mulching in plant beds to resist plant pests and naturally suppress weeds. The City employed good sanitation and removal of water sources for pest prevention, and used baits and traps to monitor pest populations. The City required all staff who apply pesticides to obtain a Qualified Applicator Certification (QAC) within the first year of employment and maintain the certification through continuing education. Staff training included the annual IPM training provided by the City, and seminars through a Pesticide Control Advisor (PAC) and professional organizations. Staff increased monitoring of contractor compliance through review of each pesticide control application to ensure it complied with the City's IPM Policy.

Enhancements to IPM Practices Planned for the Next Permit Term

In the next permit term, the City plans to update its pesticide tracking system. To improve pesticide tracking, the Parks Division plans to include pest control applications by individual QAC holders as part of the standard Lucity work order system software.

5.12. City of Saratoga

Improvements to IPM Practices in the Last Five Years

To deter weeds, the City planted photinia along all fence lines, and contracted for a special mower to remove roadside weeds.

The City also ceased glyphosate application in City parks, passed those restrictions on to contractors, and employed more staff to more diligently monitor contractor applications. The City purchased easier-to-clean plastic picnic tables and cleaned them weekly to deter wasps and ants.

The City implemented sanitation BMPs in City facilities to deter ants and other insects. BMPs include nightly housekeeping and trash removal and conducting cleanups immediately after all rental events and parties. Staff conducted walk-around inspections of buildings, and if any pest issues were noticed indoors, gaps/openings which might allow pest access were immediately sealed.

The City increased the number of staff receiving IPM training over the past five years, and the facilities supervisor and lead worker attended online EPA IPM seminars.

Enhancements to IPM Practices Planned for the Next Permit Term

As organic pesticides become more common, effective and affordable, the City plans to increase areas that are glyphosate free. The City plans to continue to require staff and contractors to explore and implement new IPM practices.

5.13. City of Sunnyvale

Improvements to IPM Practices in the Last Five Years

City staff inspected sites that are maintained by a contractor to ensure that pesticides are used only as a last resort. The City updated its pesticide tracking system with the SCVURPPP Pesticide Tracking Worksheet. Trainings on IPM for parks, sewer, and streets staff were enhanced with training materials on current practices, data on applied amounts, and highlighted pesticides of concern.

The City conducted extensive outreach to residents on IPM. During FY 2017/18, the IPM outreach was conducted at 42 events and through 14 informative social media posts, movie theater ads and emails. During FY 2018/19, outreach was conducted at 31 events and via 36 informative social media posts, movie theater ads and emails.

Enhancements to IPM Practices Planned for the Next Permit Term

The City plans to update the pesticide tracking system yearly to ensure that it; (a) reflects up-to-date pesticides of concern used by the City; and (b) maintains formula accuracy. The City also plans to enhance staff trainings on IPM by increasing the number of training events, such as department tailgates and continued annual trainings.

5.14. County of Santa Clara

Through a combination of innovation, sustainable culture, and operational policy, the County of Santa Clara has been able to significantly reduce pesticide applications.

- The County operated 27 out of 29 parks pesticide free in FY 2018-19. Up from 21 in 2015, and only 15 parks in 2005.
- During the past five years the County has averaged only 245 acres of roadside under chemical vegetation management, compared to an average of over 2,100 acres in 2005.

- Pesticide applications in and around County airports, structures, and urban turf and landscapes in the past five years have been all but eliminated.
- Pursuant to the County IPM ordinance, the addition of Glyphosate to the California Proposition 65 list has prompted the product's removal from the County's list of approved pesticides. Existing stocks of this herbicide have been depleted and no further use will be approved.

The County uses a variety of non-chemical practices including: cattle and goat grazing in creek corridors, installation of weed fabric, manual removal of weeds, mowing, disking, conversion of lawn and turf to landscaping with native plants, barn owl nesting boxes, burrow collapsing, canine early detection of bed bugs followed by vacuuming and steaming, vertebrate trapping, fungal infection of cockroaches, and proper sanitation, maintenance and housekeeping.

The County leased one park to an organic farm, which showcases IPM practices through various events, tours, and programs. Visitors learn the importance of soil health and optimum biological activity to promote plant vitality and pest resistance, along with the augmentation of beneficial bugs to prevent, suppress, or control pests. The farm employs mechanical methods with both hand weeding and handheld flame weeders, as well as tractor-mounted flammers and insect vacuums.

In 2017, the County established a website to educate the community on sustainable landscape design, implementation, and maintenance. The site includes how to select the right plant for a specific location, and where to purchase native plants locally.

Enhancements to IPM Practices Planned for the Next Permit Term

The County plans to focus on researching least-toxic products and practices to control roadside vegetation in areas where mechanical vegetation control is precluded due to terrain conditions and traffic hazards, a critical need for wildfire prevention.

The County also plans on implementing an IPM spatial monitoring and data collection software to collect and analyze IPM data to be more proactive in pest management decisions.

5.15. Santa Clara Valley Water District (Valley Water)

Improvements to IPM Practices in the Last Five Years

Valley Water made the following improvements to its IPM program:

- Updated both its Pesticide Policy and the Approved Pesticide list in 2018. One significant change was limiting the use of pesticides to only caution label products.
- Increased use of goat grazing, evaluated aquatic herbicide applications to ensure minimal herbicide usage by coordinating hand removal activities prior to chemical treatments, and tested and investigated new herbicide products.
- Updated its pesticide tracking system to be able to track treatments, products, gallons, target pests, IPM strategies and other pertinent comments specific to each treatment site.
- Enhanced staff trainings with inclusion of topics such as plant identification and calibration, in addition to label and Safety Data Sheets training. Valley Water is designing new trainings on IPM for staff for implementation in fall 2019.

- Prepared fact sheets for residents on topics such as Valley Water’s invasive plant management program, and use of glyphosate products.
- Hosted quarterly weed management area meetings at Valley Water Vegetation Field Operations facility.
- Ensured that Valley Water’s Pesticide Control Advisor (PCA) attended quarterly Santa Clara County IPM TAG meetings.
- Required that contractors performing any vegetation work for Vegetation Field Operations (VFO) are supervised by Valley Water maintenance staff. VFO also controls all herbicide products, mixing, loading and application.
- Created a new position to oversee tracking of the invasive plant management program and increased monitoring of post herbicide efficacy on invasive plants.

Enhancements to IPM Practices Planned for the Next Permit Term

Valley Water plans to make the following improvements to its pesticide program:

- As necessary, modify the Approved Pesticide List as new products that meet the Pesticide Policy become available.
- Expand the use of mulches and increase grazing in summer of 2020.
- Improve outreach to residents by sending project specific notices for invasive plant management work each summer.

Valley Water is designing a program to evaluate efficacy of various herbicide treatments on *Arundo donax*, and plans to implement the program in spring of 2020.

6.0 CONCLUSIONS

Through the development of this pesticide source control effectiveness evaluation report, SCVURPPP and its Permittees agencies have complied with the requirements in MRP Provision C.9.g by:

- Evaluating the effectiveness of pesticide source control measures implemented;
- Evaluating the attainment of TMDL/WQAS pesticide concentration and toxicity targets for water and sediment.
- Describing the improvements to Permittee IPM programs in the last five years; and
- Describing the improvements planned during the next Permit term.

This section summarizes the conclusions of the evaluation, including source control measures that SCVURPPP and its Permittee agencies should continue to implement and potential enhancements to assist in achieving targets for pesticide concentrations and pesticide-related toxicity in Santa Clara Valley urban creeks.

6.1. Summary of Implementation Assessment Outcomes (Levels 1 - 4)

SCVURPPP Permittee agencies have successfully implemented a number of source control measures consistent with Provision C.9 of the MRP and the TMDL/WQAS implementation plan (see Section 3.2). For example, the following Level 1 through 4 outcomes have been achieved as a result of control measure implementation:

- All SCVURPPP permittee agencies have adopted IPM policies/ordinances and established pesticide application SOPs. All municipal staff that apply pesticides receive training on the IPM policy. IPM Policies and pesticide programs have led to an increase in awareness about pesticide impacts and a change in behavior by municipal employees and contractors. SCVURPPP permittee agencies are either not using pesticides of concern, or using them in minimal quantities, and only as a last resort.
- All permittee agencies that use contractors to apply pesticides have contract specifications in place that require contractors to follow the IPM Policy and implement IPM.
- SCVURPPP agencies are working with the County HHW Program to ensure that adequate pesticide disposal services are available to all residents. For example, in both FY 16-17 and FY 17-18, the HHW Program managed more than 300,000 pounds of liquid and solid poisons (including pesticides) per year.
- SCVURPPP implements the OWOW Program in local retail stores and nurseries to provide less-toxic pest control information to residents at the point of purchase. From FY 13-14 through FY 17-18, SCVURPPP sponsored 55 store employee trainings and trained 488 employees. The willingness of store managers to participate in the OWOW Program and send employees to trainings reflects the changing attitude of pesticide sellers toward IPM and the use of less-toxic pest control methods. Regional OWOW Program leaders report an overall increase in sales of less toxic products as a result of the OWOW Program's implementation.
- SCVURPPP's various efforts to educate residents about pesticides and IPM, including media advertising, website postings and distribution of outreach materials at events, raise awareness among residences and lead to increased use of IPM and decreased use of toxic pesticides. Information on less-toxic pest control is posted on the Watershed Watch Campaign website (www.MyWatershedWatch.org).
- SCVURPPP is continuing to educate pest control professionals on IPM and water quality issues by sending them informational letters and publishing articles in the Department of Agriculture's newsletter.
- From FY 13-14 to FY 18-19, a total of 108 individuals completed the Basic Green Gardener Training and learned sustainable landscaping practices, including IPM, which they can implement at their client sites.
- As a result of SCVURPPP and Permittee efforts to reduce pesticide use at new development and redevelopment sites, project developer behavior is changing and resulting in an increase in the number of development projects that use "beneficial landscaping" techniques that minimize pesticides, fertilizers, irrigation, and runoff. In FY 13-14, only 49% of approved regulated projects

included “beneficial landscaping”, compared to 77% in FY 17-18. These data suggest that Program and Permittee efforts are reducing the potential for water quality impacts attributable to pesticide usage at new development and redevelopment projects.

- All permittees have made significant improvements to their IPM programs in the last five years. Figure 6-1 shows an overview of the types of improvements made, and the number of Permittee agencies that made these improvements. Most commonly reported by Permittees was improving their pest management practices to incorporate IPM, followed by enhancing staff trainings on IPM and updating IPM Policies/SOPs.

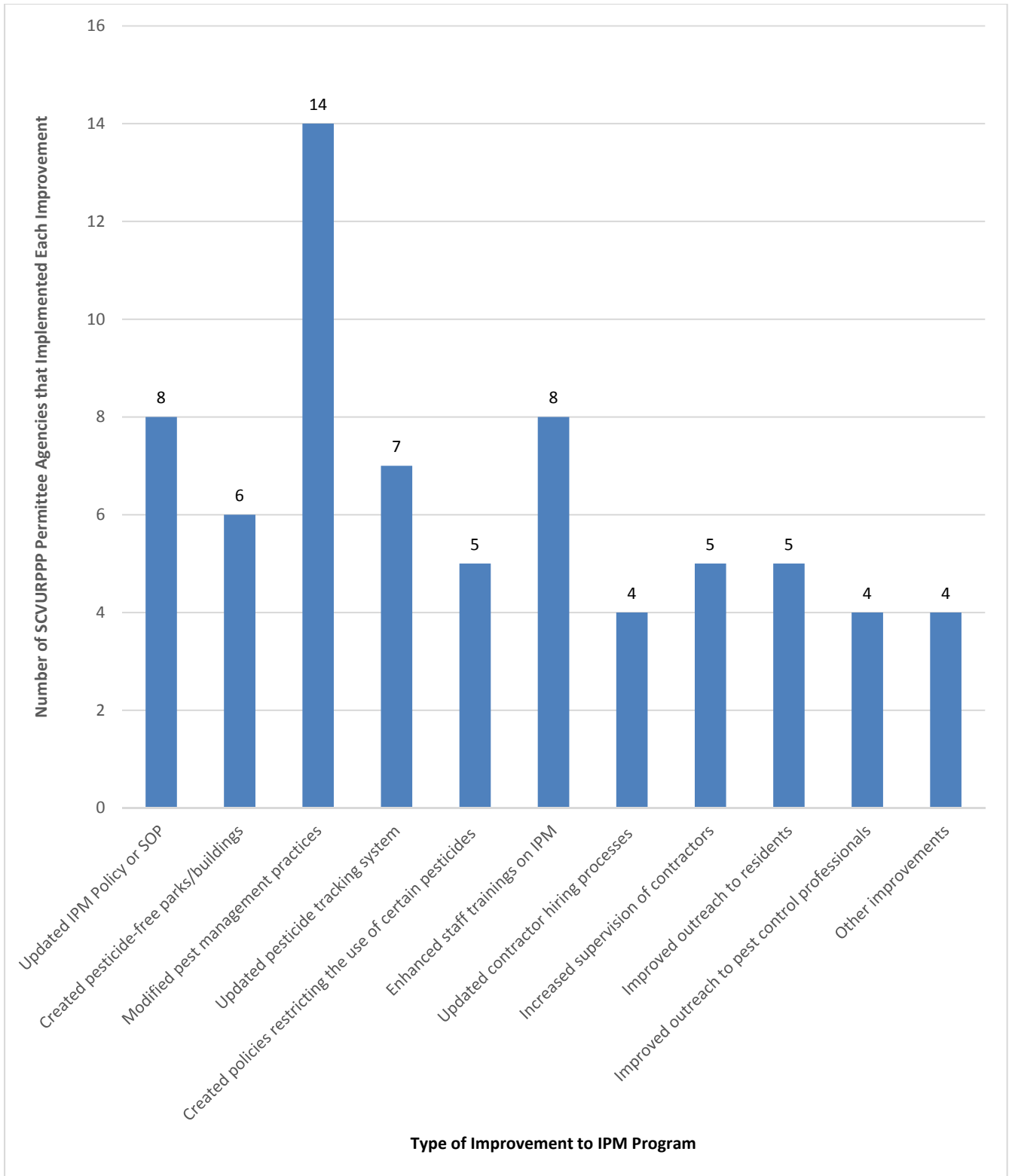


Figure 6-1. Summary of Improvements Made to SCVURPPP Permittee IPM Programs from FY 13-14 to FY 18-19.

6.2. Summary of Water Quality Assessment Outcomes (Level 6)

Over the course of the last decade a number of monitoring programs have tested for pesticides and toxicity in water and sediment from Santa Clara Valley urban creeks. SCVURPPP has monitored urban creeks since the early 2000s, consistent with NPDES municipal stormwater permit requirements, and other programs have collected additional data, as described in Section 4.1. Based on evaluation of these data, the following Level 6 outcomes were observed:

- The available monitoring data suggest that diazinon is no longer a concern in Santa Clara Valley urban creeks. From 2002 to 2018, diazinon concentrations have been well below the TMDL/WQAS target (i.e., 100 ng/L). In addition, acute toxicity to *Ceriodaphnia dubia* has not been observed in water samples collected from Santa Clara Valley urban creeks since 2005. These results correspond to the timeframe when diazinon and chlorpyrifos were phased out of use in urban areas and further support the hypothesis that *Ceriodaphnia dubia* toxicity exhibited in the 1990s was attributable to this organophosphate pesticide.
- Pesticides that have gained market share during the past decade (e.g., pyrethroids, fipronil, and neonicotinoids) are a potential concern in Santa Clara Valley urban creeks. Based on the sediment chemistry data compiled, pesticide concentrations and related toxicity are declining. TOC-normalized concentrations of pyrethroids in sediment samples have decreased since 2013. Furthermore, with the exception of one bifenthrin sample (collected in 2016), concentrations of pyrethroids and fipronil have not exceeded adverse effects thresholds since 2013. In 2002 to 2013, 46% (47 of 103) of bedded sediment samples collected from Santa Clara Valley urban creeks were acutely toxic to the test organism *Hyaella azteca* (an organism known to be sensitive to pyrethroids); whereas, only 15% (5 of 33) of bedded sediment samples collected from 2014 to 2018 were acutely toxic to *Hyaella azteca*.
- Statewide, pyrethroids such as bifenthrin are still the most widely detected pesticides and were considered to be the leading cause of pesticide-related toxicity in urban areas, based on data collected from 2003 to 2012 (Ruby 2013). However, imidacloprid, a neonicotinoid pesticide with potential impacts to bee populations, is being detected more frequently throughout Northern California (Ensminger 2017) and was recently added to the SPoT program (2015) and to MRP monitoring (2016) in Santa Clara Valley. Imidacloprid was detected in one of 13 water samples analyzed for this pesticide in Santa Clara Valley urban streams.

7.0 NEXT STEPS

Considering the results of this pesticide source control effectiveness evaluation, the Program and permittees plan to continue to implement pesticide source control measures, in an effort to not only reduce the impacts of current pesticides of concern, but also reduce the risk of future pesticides types from impacting Santa Clara Valley creeks and the San Francisco Bay. Based on the evaluation of available water quality monitoring results, pesticides that have gained market share during the past decade (e.g., pyrethroids, fipronil, and neonicotinoids) may be of particular concern in Santa Clara Valley urban creeks.

7.1. Program Level

The SCVURPPP plans to continue its pesticide source control efforts described previously in this report. In particular, the Program will conduct the following activities:

- **Continue Active Participation in the Regulatory Process** - Since municipal agencies do not have the authority to ban or place significant restrictions on pesticide sales or use within their jurisdiction, it is essential that the Program and permittees continue to try to influence the pesticide approval and registration process. The Program will continue to work with CASQA to communicate to the USEPA Office of Pesticide Programs and the California DPR the need to fully consider the impact on water quality during the pesticide approval and registration process. CASQA plans to undertake activities to both address near-term pesticide concerns and seek long-term regulatory change. CASQA's current priority activities are as follows:
 - Continue collaboration with DPR to address near-term regulatory concerns, while seeking OPP and OW actions to reduce inconsistencies:
 - Ensure DPR action on fipronil water pollution is completed, including professional user education about new restrictions on its outdoor urban use
 - Ensure DPR enforces mitigation measures for pyrethroids and adopts additional measures as necessary
 - Ensure the state continues to conduct surveillance monitoring to evaluate pyrethroids (and fipronil) mitigation effectiveness and to evaluate occurrence of new threats like imidacloprid and other neonicotinoid insecticides
 - Continue to encourage EPA to complete scientific groundwork and to identify and implement pyrethroids, fipronil, malathion, and imidacloprid mitigation measures, recognizing that it is likely that necessary mitigation cannot readily be implemented entirely by DPR
 - Focus on providing EPA with detailed scientific information to support mitigation strategies appropriate in the urban context
 - Seek long-term changes in the pesticide regulatory structure:
 - Leverage success at the state level and continue to be a key stakeholder in the STORMS project that is developing statewide Water Quality Control Plan amendments for urban pesticides reduction. Through this process, work with other stakeholders to implement the planned restructuring of California's urban surface water pesticides monitoring to increase its effectiveness and improve coordination.
 - Seek procedure changes such that DPR continues to refine its registration procedures to address remaining gaps in water quality protection.
- **Continue Outreach to Residents** – The Program and Permittees will continue to conduct outreach to pesticide users (i.e., residents who either themselves apply pesticides, or hire professionals who provide pest control services). This includes conducting media outreach, outreach at events, and point of purchase outreach at local stores.
- **Continue Outreach to Structural Pest Control Professionals** – The Program will continue to work with the County Division of Agriculture to conduct outreach to structural pest control professionals.

- **Continue Implementing the Santa Clara Valley Green Gardener Program** – The Program will continue implementing the Santa Clara Valley Green Gardener Program to educate landscape maintenance professionals on sustainable landscaping techniques. Continuing this program is important to ensure that landscape workers are aware of IPM practices.
- **Continue Implementing a Water Quality Monitoring Program** - The Program plans to continue to implement its water quality monitoring program and to evaluate the results (and the results from other applicable local monitoring programs) for the attainment of pesticide concentration and toxicity targets for water and sediment and any changes in water quality regarding pesticide toxicity in urban creeks.

7.2. Permittee Level

SCVURPPP Permittees plan to continue their pesticide source control activities and also plan to make selected enhancements to these efforts, including the following:

- **Continue Providing Disposal Locations for HHW, including Pesticides** – Permittees will continue to work with the County HHW Program to provide free pesticide disposal locations to residents.
- **Continue Requiring New Development and Redevelopment Projects to Implement “Beneficial Landscaping” Techniques** – Permittees will continue to encourage the inclusion of “beneficial landscaping” techniques in new and redevelopment projects. As indicated by data, the number of projects including beneficial techniques is increasing due to efforts made by the Program and Permittee staff that review projects.
- **Continue Implementing Local IPM Programs** – SCVURPPP Permittees will continue implementing and as appropriate improving their local IPM Programs to reduce the use of pesticides of concern.
- **Specific Enhancements to Local IPM Programs** – Figure 7-1 below summarizes specific enhancements that Permittees plan to make in the upcoming Permit term. These enhancements were described in more detail in Section 5. The most commonly planned actions are to improve staff trainings, enhance pest management practices, and update IPM policy/SOPs. It is recommended that Permittees incorporate information on pesticides of concern in the trainings, along with information on water quality issues associated with pesticides.

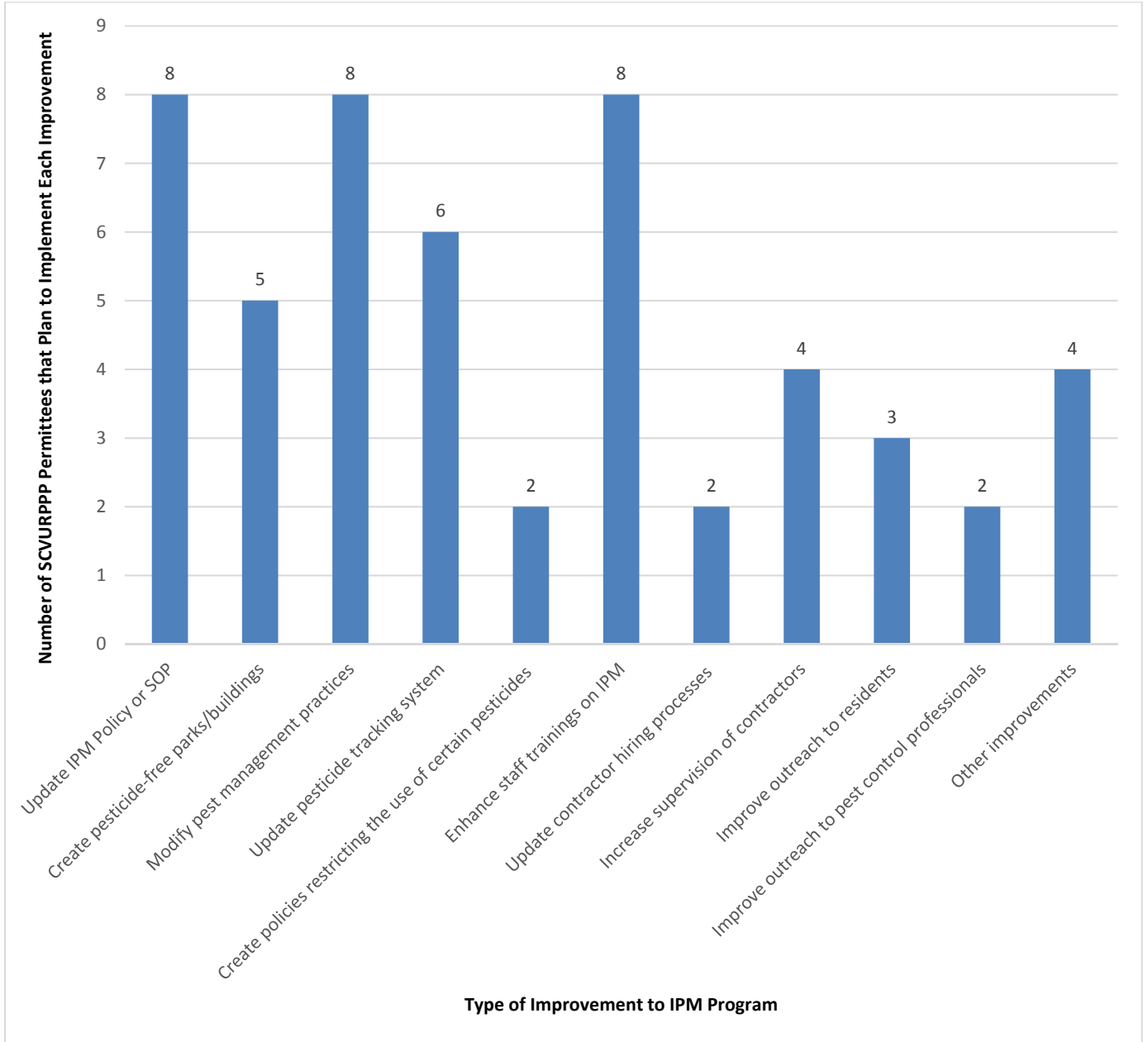


Figure 7-1. Specific Enhancements Planned to Permittee IPM Programs in the Next Permit Term.

8.0 REFERENCES

- Amweg, E.L., Weston, D.P., Ureda, N.M. 2005. Use and toxicity of pyrethroid pesticides in the Central Valley, CA. *Environ. Toxicol. Chem.* 24(4), 966-972, with erratum in 24(5), 1300-1301.
- BASMAA. 2011a. Regional Monitoring Coalition Final Creek Status and Long-Term Trends Monitoring Plan. Bay Area Stormwater Management Agencies Association. Prepared by EOA, Inc. Oakland, CA. 23 pp.
- BASMAA. 2012. Creek Status Monitoring Program Standard Operating Procedures. Prepared for Bay Area Stormwater Management Agencies Association by: EOA, Inc., Applied Marine Sciences and Armand Ruby Consulting. 196 pp.
- Budd, R. 2018. Urban Monitoring in Southern California watersheds FY 2016-2017. Prepared by California Department of Pesticide Regulation Environmental Monitoring Branch.
- CASQA. 2015. A Strategic Approach to Planning for and Assessing the Effectiveness of Stormwater Programs.
- Ensminger, M. 2017. Ambient Monitoring in Urban Areas in Northern California for FY 2016-2017. Prepared by California Department of Pesticide Regulation Environmental Monitoring Branch.
- Lowe, S.B., Anderson, B.S., and Phillips, B.M. 2007. Final Project Report: Investigations of Sources and Effects of Pyrethroid Pesticides in Watersheds of the San Francisco Bay Estuary. Proposition 13 PRISM Grant #0141355520. SFEI Contribution #523. San Francisco Estuary Institute. Oakland, CA.
- Maul, J.D., Brennan, A.A., Harwood, A.D., and Lydy, M.J. 2008. Effect of sediment-associated pyrethroids, fipronil, and metabolites on *Chironomus tentans* growth rate, body mass, condition index, immobilization, and survival. *Environ. Toxicol. Chem.* 27 (12): 2582–2590.
- Maund, S.J., Hamer, M.J., Lane, M.C.G., Farrelly, E., Rapley, J.H., Goggin, U.M., and Gentle, W.E. 2002. Partitioning, bioavailability, and toxicity of the pyrethroid cypermethrin in sediments. *Environ. Toxicol. Chem.* 21(1), 9-15.
- Ruby, A. 2013. Review of pyrethroid, fipronil and toxicity monitoring data from California urban watersheds. Prepared for the California Stormwater Quality Association (CASQA) by Armand Ruby Consulting. 22 p + appendices.
- Sanders, C.J., Orlando, J.L., and Hladik, M.L. 2018. Detections of Current-Use Pesticides at 12 Surface Water Sites in California During a 2-Year Period Beginning in 2015. Prepared in cooperation with the Central Valley Regional Water Quality Control Board. U.S. Geological Survey Data Series 1088.
- SCVURPPP. 2002. Santa Clara Valley Urban Runoff Pollution Prevention Program Pesticide Management Plan: Goals, Actions, and Monitoring Mechanisms. Last revised on February 15, 2002. Prepared by EOA, Inc., Oakland, CA.

- SCVURPPP. 2007. Santa Clara Valley Urban Runoff Pollution Prevention Program Monitoring and Assessment Summary Report. Santa Clara Basin Creeks (2002-2007). September 15, 2007. Prepared by EOA, Inc., Oakland, CA.
- SCVURPPP. 2008. Santa Clara Valley Urban Runoff Pollution Prevention Program. Watershed Monitoring and Assessment Program. Investigative Monitoring Project. Water and Sediment Quality and Toxicity in Stevens Creek, Santa Clara County, California. September 15, 2008. Prepared by EOA, Inc., Oakland, CA.
- SCVURPPP. 2017. Upper Penitencia Creek Stressor Source Identification Project. March 31, 2017.
- SCVURPPP. 2018. Coyote Creek Toxicity Stressor Source Identification Project. Work Plan – Water Year 2018. March 31, 2018.
- SFBRWQCB. 2005. Total Maximum Daily Load (TMDL) and Water Quality Attainment Strategy for Diazinon and Pesticide-related Toxicity in San Francisco Bay Urban Creeks. Staff Report. San Francisco Bay Regional Water Quality Control Board.
- SFBRWQCB. 2015. Municipal Regional Stormwater NPDES Permit. Order No. R2-2015-0049. NPDES Permit No. CAS612008. State Water Resources Control Board (SWRCB), Alameda County Flood Control and Water Conservation District, and Alameda Countywide Clean Water Program. 1997. Diazinon in Surface Waters in the San Francisco Bay Area: Occurrence and Potential Impact, prepared by R. Katznelson, Woodward Clyde Consultants, and T. Mumley, San Francisco Bay Regional Water Quality Control Board, June 30.
- USEPA. 1998. Review of California's 303(d) List. United States Environmental Protection Agency. Letter from Alexis Strauss, USEPA, to Walt Pettit, SWRCB.
- USEPA. 2017. Registration Reviews: Neonicotinoid Risk Assessments; Neonicotinoid Benefits Assessments. <https://www.regulations.gov/document?D=EPA-HQ-OPP-2008-0844-1260>.
- Weston, D.P., Poynton, H.C., Wellborn, G.A., Lydy, M.J., Blalock, B.J., Sepulveda, M.S., and Colbourne, J.K. 2013. Multiple origins of pyrethroid insecticide resistance across the species complex of a nontarget aquatic crustacean, *Hyalella azteca*. *Proc. Natl. Acad. Sci.* 110, 16532– 16537.