

Pesticide Source Control Actions Effectiveness Evaluation

Submitted by the San Mateo Countywide Water Pollution Prevention Program (SMCWPPP), on behalf of all San Mateo County 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)
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
OSH	Orchard Supply Hardware
0&M	Operation and Maintenance
OWOW	Our Water Our World
PCO	Pest Control Operator
RMC	BASMAA Regional Monitoring Coalition
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board
SFEI	San Francisco Estuary Institute
SMCWPPP	San Mateo Countywide Water 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
VSQG	Very Small Quantity Generator (VSQG)
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 (SFRBWQCB 2015). This report describes the source control measures implemented by the San Mateo Countywide Water Pollution Prevention Program (SMCWPPP) and the 22 MRP Permittee municipal agencies in San Mateo County¹ 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 of pesticide source control actions is based on available data from (including Permittee activities during) approximately the preceding five years (FY 2013-14 to FY 2017-18²). Per MRP requirements, it includes a discussion of improvements made by each San Mateo County Permittee in implementing pesticide source control actions in about the preceding five years, 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

¹The 22 MRP Permittee municipal agencies in San Mateo County are comprised of 20 cities/towns, the County of San Mateo, and the San Mateo County Flood Control District.

²When available, data for FY 2018-19 are also generally included.

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.

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 San Mateo 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 / No Observable Adverse Effects Concentration (NOAEC)

TU_c = 100 / 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 non-municipal use of pesticides in MS4 discharges. Pesticide control measures implemented by Permittees 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 concern³ to water quality in Bay Area urban creeks.

- Organophosphate products (example active ingredients: diazinon, chlorpyrifos, malathion);
- Carbamate products (example active ingredients: carbaryl and aldicarb⁴);
- 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
- Indoxacarb

³The pesticides of concern list was updated in 2015 to include diamides, diuron, and indoxacarb.

⁴Currently, 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.

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).

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, San Mateo County 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

SMCWPPP and San Mateo County Permittees have implemented source control measures to control pesticide pollution for over 15 years. Source control measures were enhanced, as needed, to meet MRP requirements to reduce pesticide-related toxicity in urban creeks. 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;
- Coordinating with the County Agricultural Commissioner;
- 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

Before the adoption of the MRP 1.0 in 2009, SMCWPPP implemented a creek water quality monitoring program (beginning in the early 2000s) that included collecting grab samples from selected urban creeks and analyzing for organophosphate pesticides and water column toxicity. The results of this monitoring were summarized in several technical reports submitted to the Regional Water Board (e.g., SMCWPPP 2005a, 2005b, 2006, 2007).

MRP Monitoring

With the adoption of the MRP, SMCWPPP 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, SMCWPPP conducted annual dry season monitoring at two locations for toxicity in water and sediments and pesticides in sediments. Water column samples were collected from same two 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, SMCWPPP continued conducting pesticides and toxicity monitoring in compliance with Provision C.8.g. Dry weather monitoring is conducted at one location 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, SMCWPPP was required to collect a total of two 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.

Statewide Monitoring Program

Under Objective 6 of the Strategy to Optimize Resource Management of Storm Water (STORMS), adopted by the 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 SMCWPPP and San Mateo County 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 SMCWPPP and Permittee Annual Reports. Water quality monitoring data collected by SMCWPPP 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:

- 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 are 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 change behavior in 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, 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 SMCWPPP and San Mateo County MRP 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 San Mateo County Permittees have adopted IPM policies/ordinances and established pesticide application Standard Operating Procedures (SOPs). Many San Mateo County MRP Permittees adopted IPM Policies in 2003. After MRP 1.0 was adopted, SMCWPPP developed the SMCWPPP Model IPM Policy and a template of pesticide application SOPs. Both of these were used by Permittee agencies to update their local IPM Policies and SOPs. The date of adoption of IPM Policies by San Mateo County MRP Permittees is below:

- Atherton 2003
- Belmont, Brisbane, Daly City, Portola Valley 2010
- Burlingame, Colma, Foster City, Redwood City, San Bruno, Half Moon Bay, San Carlos, San Mateo adopted 2003, revised and adopted in 2011
- East Palo Alto 2012
- Hillsborough adopted 2003, revised and adopted in 2011, updated in 2019
- Menlo Park 1998
- Millbrae 2004
- Pacifica 2011

- San Mateo County and San Mateo County Flood Control District adopted 2010, revised and adopted in 2012
- San Mateo adopted 2003
- South San Francisco adopted 2010, revised and adopted 2011
- Woodside adopted 2004, updated 2011

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 San Mateo County Permittees. Another measure is demonstration of IPM tactics that Permittees have implemented. San Mateo County Permittees report both of these via their Annual Reports to the Regional Water Board. Available use data 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 generally only as a last resort:

- 14 Permittees reported that they have not used any pesticides of concern from FY 2013-14 to FY 2017-18⁵. Four Permittees reported using a pesticide of concern in only one fiscal year from FY 2013-14 to FY 2017-18. Four Permittees reported using a pesticide of concern in more than one fiscal year.
- The Permittees that reported using pesticides of concern generally did so only as a last resort and provided a reason for the use. 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.
- The pesticides of concern that Permittees generally reported using are pyrethroids, fipronil, and indoxacarb. Fipronil was used by only one Permittee, in one fiscal year.
- Permittees did not report using any of the other pesticides of concern (carbamates, organophosphates, diuron, and diamides) from FY 2013-14 FY 2017-18.

Table 3-1 summarizes the pesticides of concern usage reported by San Mateo County Permittees from FY 2015-16 to 2017-18.

⁵Data for FY 2018-19 were not available at the time of writing this report.

Table 3-1. Summary of pesticide of concern use by San Mateo County Permittees that reported using pesticides of concern between FY 2013-14 and FY 2017-18¹

Permittee	FY 2013-14	FY 2014-15	FY 2015-16	FY 2016-17	FY 2017-18
Atherton	None used	None used	0.09 oz of lambda- cyhalothrin; 1 oz of deltamethrin	0.08 oz of lambda- cyhalothrin; 0.005 oz of deltamethrin	0.17 oz of lambda- cyhalothrin
Belmont	None used	None used	None used	None used	None used
Brisbane	None used	None used	None used	None used	None used
Burlingame	None used	None used	None used	None used	None used
Colma	1.5oz of Talstar P Professional ² (bifenthrin)	None used	None used	None used	None used
Daly City	None used	None used	None used	None used	None used
East Palo Alto	1.1oz (concentrated) of Cy-Kick CS ² .05% (pyrethroid)	None used	None used	None used	None used
Foster City	None used	None used	None used 8.46 grams of indoxacarb		6.55 grams of indoxacarb
Half Moon Bay	None used	None used	None used	None used	None used
Hillsborough	None used	None used	None used	0.1 gallon of indoxacarb	None used
Menlo Park	None used	None used	None used	None used	None used
Millbrae	None used	None used	None used	None used	None used
Pacifica	None used	None used	None used	None used	None used
Redwood City	None used	None used	None used	None used	None used
San Bruno	None used	None used	None used	None used	None used
San Carlos	None used	None used	None used	None used	None used
San Mateo	O.045 oz of cyfluthrin	None used	None used	0.234 oz of cyfluthrin; 0.02912oz of fipronil; 0.48 oz of indoxacarb; and 120 mg of indoxacarb	None used

Permittee	FY 2013-14	FY 2014-15	FY 2015-16	FY 2016-17	FY 2017-18
County of San	0.5 oz of Suspend	0.025 oz of	0.01 oz of	0.51 oz of	0.21 oz of
Mateo	(deltamethrin)	(deltamethrin)	deitamethrin; 0.12 oz of pyrethrin; 0.03 oz of esfenyalerate	deitamethrin; 3.42 oz of indoxacarb	deitamethrin; 0.43oz of indoxacarb
San Mateo County Flood Control District	None used	None used	None used	None used	None used
South San Francisco	None used	None used	None used	None used	0.35 oz of permethrin
Woodside	None used	None used	None used	None used	None used

¹Prior to FY 2015-16, reporting the quantity of active ingredients was not required, and Permittees reported the total quantity of the pesticide product used.

²Total quantity of product used, not total quantity of active ingredient.

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 San Mateo County Permittees ensure that staff responsible for applying pesticides is familiar with their agency's IPM Policy, SOPs and new and current IPM techniques. Staff attends trainings held by individual Permittees and/or the annual IPM trainings conducted by SMCWPPP, including the following recent trainings:

• A total of 90 municipal staff attended SMCWPPP's Annual Landscape Maintenance IPM Training Workshop held on March 7, 2018, and 87 municipal staff attended SMCWPPP's Annual Landscape Maintenance IPM Training Workshop on March 8, 2017.

Some Permittees also sent staff to trainings held by other organizations (e.g., Pesticide Applicators Professional Association IPM Trainings). An evaluation of Annual Report data the following:

- Five San Mateo County Permittees do not have employees that apply pesticides.
- All San Mateo County Permittees that have employees that apply pesticides conduct annual trainings to ensure that municipal employees that apply pesticides are trained on the Permittee's IPM policy/ordinance, and IPM techniques.

Table 3-2 summarizes the training data from FY 2015-16 to FY 2017-18.⁶

⁶Prior to FY 2015-16, Permittees were not required to report on annual training.

Metric	FY 2015-16	FY 2016-17	FY 2017-18
Total number of San Mateo County Permittee employees that applied or used pesticides	146	141	129
Total number of Permittee employees that received trainings on the IPM policy and procedures	146	140	129
Percentage of Permittee employees that apply pesticides and have received training on the IPM policy and procedures	100%	99%	100%

Table 3-2. Summary of SMCWPPP Permittee Employee Trainings

Level 2 - Barriers and Bridges to Action

The IPM trainings help increase the awareness on 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 IPM and other trainings, municipal staff's awareness of IPM and the use of less toxic pesticides was raised.

The IPM trainings cover a wide range of topics that help increase attendees' awareness of IPM techniques. After each workshop attendees are requested to complete an evaluation form. The positive feedback provided indicated that attendees found the workshops helpful, supporting the notion that the workshops increase awareness among municipal staff. For example:

- SMCWPPP 2018 Annual Landscape Maintenance IPM Training Workshop 93% of respondents to the evaluation form said that the workshop met their expectations, 93% said that they found the presentation on "Controlling White Grubs and Yellowjackets" very helpful, and 90% of respondents said that they found the presentation on "Gopher, Raccoon, and Bee Control" very helpful.
- SMCWPPP 2017 Annual Landscape Maintenance IPM Training Workshop 96% of the respondents to the evaluation form said that the workshop met their expectations, 84% of the respondents said that they found the presentation on "IPM for Phytophthora diseases and emerging pests" very helpful, and 76% of respondents said that they found the presentation on "Bay Friendly Landscaping" very helpful.

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

As discussed earlier, a preliminary analysis of the reported pesticide use data indicates that San Mateo County 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 San Mateo County Permittees 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

All Permittees that use contractors to apply pesticides have either 1) hired contractors that are IPMcertified (e.g., Eco-wise, Green Pro and Green Shield) and/or have taken the Bay-Friendly Landscaper Training, or 2) have contract specifications in place that require contractors to follow the IPM Policy and implement IPM. Of the 20 San Mateo County Permittees that hire contractors, 17 require that contractors obtain permission from the Permittee prior to applying pesticides. All Permittees 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.

To educate municipal staff on managing pest control contractors, SMCWPPP held a workshop titled *Working with Pest Control Contractors to Ensure Stormwater Permit Compliance* on May 14, 2018. The workshop was geared toward municipal IPM coordinators, municipals staff that hire and supervise structural or landscape pest control contractors, municipal facilities managers, and municipal staff responsible for completing the pesticides section of the stormwater permit annual report. The workshop was attended by 28 municipal staff and contractors.

Outcome Level 2 – Barriers and Bridges to Action

The Working with Pest Control Contractors to Ensure Stormwater Permit Compliance workshop educated attendees about permit requirements and contract management. After the workshop, attendees were requested to complete an evaluation form, and 88% of the respondents said that the workshop met their expectations, 59% of the respondents said that they found the presentation on "Ins and Outs of IPM Contract Management" very helpful.

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 SMCWPPP and San Mateo County Permittees 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 its 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 addresses 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, SMCWPPP 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 Action

CASQA efforts, which have been supported and partly funded by SMCWPPP 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, USEPA agreed to incorporate urban uses (rightsof-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 water, storm drain, or gutter. USEPA 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, USEPA 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 USEPA 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 the San Mateo County Agricultural Commissioner

The goal of this source control measure is to coordinate with County Agricultural Commissioner staff 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

Staff from San Mateo County Agriculture/Weights and Measures regularly participates in meetings of the SMCWPPP Parks and IPM Work Group. MRP compliance and water quality and pest management issues are discussed at these meetings. In addition, SMCWPPP works closely with San Mateo County Agriculture/Weights and Measures staff to provide Department of Pesticide Regulations Continuing Education Units (CEUs) for participants in SMCWPPP's landscape IPM workshops. San Mateo County Agriculture/Weights and Measures present regulatory and pest management information to attendees at these workshops.

3.6. Public Outreach

SMCWPPP's pesticide outreach efforts generally fall into the following three categories:

- Point-of-Purchase Outreach SMCWPPP 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 SMCWPPP contracts with an IPM consultant to conduct store employee training. These trainings educate store employees on IPM and selling less-toxic products.
- 2. **Outreach to Residents** SMCWPPP utilizes media advertising, website postings and distribution of outreach materials at events to educate residents about IPM.
- Outreach to Pest Control Professionals SMCWPPP conducts targeted outreach to structural Pest Control Operators (PCOs) on IPM.

The effectiveness of the SMCWPPP public outreach program and its components is assessed at Outcome Levels 1, 2, 3, and 4. Results of the effectiveness assessment are grouped below by the above three pesticide outreach categories.

Point-of-Purchase Outreach

Outcome Level 1 - Stormwater Program Activities

Since 1999, SMCWPPP has participated in the regional effort for the OWOW program by attending all Public Information and Participation meetings with BASMAA and participating jurisdictions to coordinate the program in San Mateo County. From FY 2013-14 through FY 2017-18, SMCWPPP sponsored 44 store employee trainings and trained 390 employees. Table 3-3 summarizes employee training information from FY 2013-14 to FY 2017-18.

Fiscal Year	Number of Employees Trained					
FY 2013-14	93 employees representing 10 stores					
FY 2014-15	106 employees representing 14 stores					
FY 2015-16	48 employees representing 5 stores					
FY 2016-17	54 employees representing 5 stores					
FY 2017-18	89 employees representing 10 stores					

Table 3-3. Summary of Store Employees Trained

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

The trainings educate store employees on IPM, stormwater pollution problems and how to direct customers toward buying less-toxic products. Since FY 2017-18, SMCWPPP has included a pre-training and post-training survey to assess the increase in employee awareness. At total of 89 employees were trained in FY 2017-18, and 75 employees completed the pre-training survey, and 83 employees completed the post-training survey. Highlights of survey responses are provided below, and indicate an increase in awareness:

- After the training, 100% of survey respondents knew that water flowing into storm drains is not treated, compared to 65% of survey respondents before the training.
- After the training, 99% of survey respondents knew pesticides are not removed at the sewage treatment plant, compared to 36% of respondents before the training.
- After the training, 95% of survey respondents knew the location of the Household Hazardous Waste (HHW) collection facility, compared to 32% of respondents 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 and Outcome Level 2 - Barriers and Bridges to Action

Information on less-toxic pest control is posted on SMCWPPP's website (flowstobay.org).

In addition, SMCWPPP utilizes 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 2018-19, SMCWPPP conducted the following outreach on pesticide related topics:

- Made 32 posts of Facebook which received 12,418 impressions.
- Made 24 posts on twitter, which received 11,349 impressions.
- Posted 9 blogs on the Flows to Bay website, which received 485 page views.

During FY 2016-17, SMCWPPP implemented outreach to encourage residents to hire pest control professionals that use IPM practices. SMCWPPP distributed the OWOW fact sheet entitled "Finding a Company That Can Prevent Pest Problems." The fact sheet describe the steps residents can take once they've identified that they have a pest problem, including the hiring of a pest control operator and evaluating the types of toxic chemicals they use. The fact sheets were distributed to hardware stores, at 10 community events, and to PIP Subcommittee members to distribute throughout their municipalities. SMCWPPP's web site also has a new web page dedicated to helping the public find IPM certified contractors. The web page also contains links to the OWOW program, the EcoWise Certified program, and other pest-control resources. SMCWPP also sends newsletters to a list of opt-in subscribers with topics covering eco-friendly gardening practices and stormwater pollution prevention information and tips.

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

SMCWPPP'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 on IPM and less-toxic pest control.

While data are lacking regarding to what extent residents are implementing IPM techniques, data from the San Mateo County Health Department's Household Hazardous Waste (HHW) Collection Program and Very Small Quantity Generator (VSQG) Business Collection Program indicate that residents and small businesses in San Mateo County are continuing to properly dispose of household hazardous waste, including pesticides. Table 3-4 provides the total quantities of toxic solids and toxic liquids, including pesticides that these programs collected from FY 2013-14 to FY 2017-18.

Fiscal Year	Total Poisons Collected (pounds)
FY 2013-14	64,229
FY 2014-15	83,987
FY 2015-16	83,406
FY 2016-17	94,916
FY 2017-18	94,289
Total	420,827

Table 3-4. Quantity of total poisons (including pesticides) collected at by the County HHW and VSQGs Programs from FY 2013-14 to FY 2017-18.

From FY 2013-14 through FY 2017-18, the HHW and VSQG program collected 420,827 pounds of poisons. If not properly disposed, these HHW materials could lead to urban runoff pollution. The HHW and VSQG Programs are effective at reducing the amount of pesticides available as a potential source to urban runoff.

Outreach to Pest Control Operators (PCOs)

Outcome Level 1 - Stormwater Program Activities

Annually, SMCWPP mails an informational letter to all licensed and cleared pest control operators in San Mateo County, using the license lookup website for the California Structural Pest Control Board. The letter includes 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 letter also includes 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. To-date, seven IPM certified contractors have agreed to be listed on SMCWPPP's web page that promotes IPM-certified pest control professionals.

3.7. Minimizing Pesticide Use at New and Redevelopment Sites

The primary 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. Project designs that use efficient irrigation systems to minimize runoff are also encouraged. The effectiveness of this type of source control is assessed at Outcome Levels 1, 2, and 3.

Outcome Level 1 – Stormwater Program Activities

SMCWPPP's *Model Conditions of Approval - Permanent Stormwater Control Requirements for C.3 Regulated and Non-C.3 Regulated Projects* (July 2016), which is used by San Mateo County Permittees to review development project applications, describes measures that projects can implement to reduce pesticide pollution. San Mateo County Permittees have incorporated these types of measures into their project review and approval processes. In addition, the SMCWPPP C.3 and C.6 Development Review Checklist lists the following sustainable landscaping techniques:

• Retain existing vegetation as practicable.

- Select diverse species appropriate to the site. Include plants that are pest and/or or diseaseresistant, drought-tolerant, and/or attract beneficial insects.
- Minimize use of pesticides and quick-release fertilizers.
- Use efficient irrigation system and design to minimize runoff.

The SMCWPPP C.3 Regulated Projects Guide and Green Infrastructure Design Guide (GI Design Guide) include information on the Operation and Maintenance (O&M) of stormwater treatment measures. Resources for sustainable landscaping practices and information, such as the Bay-Friendly program developed by ReScape California and recommended in the MRP, are cited and the guidance summarized. The SMCWPPP Guides contain templates with guidance on using IPM to maintain these O&M treatment measures. The templates are posted on the SMCWPPP website and San Mateo County Permittees use them as exhibits to their stormwater treatment measure maintenance agreements. The C.3 Regulated Projects Guide 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 and other climate-appropriate species that require less water and minimum use of pesticides. The C.3 Regulated Projects Guide Projects Guide and the plant list are available on the SMCWPPP website (flowstobay.org).

SMCWPPP developed the GI Design Guide to help agencies, developers, construction firms, and design professionals design, build and maintain green infrastructure in San Mateo County. The GI Design Guide includes information on plant palettes for stormwater treatment measures, and guidance on maintaining these measures using sustainable landscaping techniques.

Outcome Level 2 – Barriers and Bridges to Action

SMCWPPP conducts an annual workshop to educate municipal staff about the MRP requirements for new and redevelopment projects. Information on Low Impact Development (LID), green streets, landscaping with native plants, and selecting plants for stormwater treatment measures is typically included in these 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. ReScape California also holds regularly scheduled workshops to train public and private sector professionals on the holistic practices of Bay-Friendly landscaping. Some San Mateo County Permittees, such as the City of South San Francisco and City of Menlo Park, have adopted Bay-Friendly Principles into their planning processes and training requirements for municipal maintenance staff.

Outcome Level 3 – Target Audience Actions

Table 3-5 summarizes data from Permittee Annual Reports on the number of regulated projects that incorporate at least one sustainable landscaping technique as a source control measure.

Year	Number of Regulated Projects Approved by San Mateo County Permittees	Number of Approved Regulated Projects that Include at least one Sustainable Landscaping Technique	Percentage of Approved Regulated Projects that Include Beneficial Landscaping				
FY 2013-14	52	31	60%				
FY 2014-15	62	35	56%				
FY 2015-16	71	49	69%				
FY 2016-17	57	38	67%				
FY 2017-18	59	39	66%				

Table 3-5. Number of Approved Regulated Projects that Include at least one Sustainable LandscapingTechnique

The data indicate that a large number of regulated projects are including at least one sustainable landscaping technique as a source control measure. The data suggest that municipal staff that review projects are continuing to encourage project applicants to include beneficial landscaping in their projects. Project applicants and developers are also 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 (Level 5) or the chemical, physical or biological condition of receiving waters (Level 6). The available applicable water quality monitoring data in San Mateo 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 San Mateo County Urban Creeks

Over the course of the past two decades a number of monitoring programs have tested for pesticides and toxicity in water and sediment from San Mateo County urban creeks:

 SMCWPPP has monitored urban creeks since the early 2000s, consistent with NPDES municipal stormwater permit requirements. 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.

- California's Surface Water Ambient Monitoring Program (SWAMP) has collected pesticide and toxicity data in San Mateo County urban creeks since 2002. These data have been collected through a number of projects implemented at the regional and statewide scales, including the Regional Water Board's regional SWAMP program, the SWRCB'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 concentration of pesticides and extent of toxicity in Bay Area urban creeks were monitored by the Clean Estuary Partnership (CEP) in 2005, including one site in San Mateo County (Ruby 2005).

4.2. Pesticides of Concern in San Mateo County Urban Creek Water and Sediment

Each program described above has measured various parameters in water and/or sediment collected from San Mateo County urban creeks. Decisions regarding parameters and sample matrices are informed by project/program objectives, the chemical characteristics of the pesticides of interest, and available resources. For example, water soluble organophosphate pesticides such as diazinon (and more recently imidacloprid) are monitored for in water samples from urban creeks. Concentrations of pyrethroid pesticides, carbaryl and fipronil, however, are generally measured in creek bedded sediment sampled from urban creeks since these types of pesticides have a higher affinity to adsorb to particles.

Since the early 2000s, the primary focus of pesticide and toxicity monitoring in urban San Mateo County has shifted from presence and effects of chlorpyrifos, diazinon, and legacy pesticides (e.g., DDT) to pyrethroids and 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 San Mateo County urban creeks and analyzed for pesticides from 2002 to 2018. These data were generated from the programs described in the previous section. During this timeframe, a total of 45 water samples collected from various sites in urban creeks were analyzed for pesticides. Samples were collected during both storm events and dry weather conditions. An additional 27 water samples were collected from non-urban creeks from 2002 to 2004.

	Data Points Collected in San Mateo Urban Creeks per Year																
Monitoring Program	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
SMCWPPP Monitoring Program																	
Pre-MRP Monitoring	-	4	6	3	6	-	-	-	-	-	-	-	-	-	-	-	-
BASMAA RMC Monitoring (MRP)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
POC Loads Monitoring	-	-	-	-	-	-	-	-	-	-	-	1	6	-	-	-	-
Surface Water Ambient Monitoring Pr	ogram	(SWAM	P)														
Region 2 (SF Bay Region) Monitoring	2	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Statewide Stream Pollution Trends (SPoT) Program	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PRISM Grant Program	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Clean Estuary Partnership (CEP)																	
Urban Pesticide Monitoring Project	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals	2	14	7	5	6	0	0	0	0	0	0	1	6	0	0	0	2

Table 4-1. Number of water samples collected from San Mateo County urban creeks and analyzed for pesticides from 2002 to 2018

Figure 4-1 compares concentrations of diazinon in these San Mateo County urban creek water samples (2002 – 2012) 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). Diazinon has not been sampled in San Mateo County urban creeks since 2006. The data indicate that diazinon concentrations measured 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.

In 2018, SMCWPPP analyzed two storm water samples collected from urban creeks for imidacloprid, a neonicotinoid pesticide that has rapidly become commonly used in recent years for indoor and outdoor pest control, pet treatments, and in construction materials. Imidacloprid was detected in one of the two samples at a concentration of 0.066 μ g/L. This concentration exceeds the USEPA proposed chronic exposure benchmark for aquatic insects in freshwater of 0.01 μ g/L but not the acute exposure benchmark of 0.385 μ g/L, nor the current acute and chronic invertebrate benchmarks of 34.5 and 1.05 μ g/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.



Figure 4-1. Diazinon concentrations in water samples collected from San Mateo 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).



4.2.2. Concentrations in Sediment

Table 4-2 summarizes the numbers of bedded sediment samples collected in San Mateo County 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 San Mateo Creek every year since 2004, and SMCWPPP 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 32 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.

Figures 4-2 through 4- 5 compare concentrations of commonly detected pyrethroids in San Mateo County urban creek sediment samples to adverse effects LC₅₀ thresholds⁷ identified in the literature (Amweg et al. 2005, Maund et al. 2002, Weston et al. 2013). Figures 4-6 through 4-8 compare concentrations of the non-pyrethroid pesticide fipronil and two of its degradates in sediment samples 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 station 204SMA020 (San Mateo Creek at Gateway Park) dataset which has been sampled every year by the SPoT program. Samples from station 204SMA020 are called out in Figures 4-2 through 4-8. Although the other stations provide a wider geographic resolution to the San Mateo dataset, none has been sampled more than once, and therefore are less informative of long-term trends. Fipronil concentrations appear to have decreased since 2014; however, the fipronil dataset is much smaller as monitoring did not begin until 2013.

Pesticide concentrations in the dataset rarely exceed adverse effects thresholds. The only exceptions are two bifenthrin samples (collected from San Mateo Creek (station 204SMA020) in 2004 and Laurel Creek in 2016) with TOC-normalized concentrations exceeding the bifenthrin LC_{50} (Figure 4-2). Bifenthrin is considered to be the leading cause of pyrethroid-related toxicity in urban areas (Ruby 2013).

⁷Lethal Concentration 50% - the dose required to kill half the members of a tested population after a specified test duration.

	Data Points Collected in San Mateo Urban Creeks per Year																
Monitoring Program	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
SMCWPPP Monitoring Program																	
Pre-MRP Monitoring	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BASMAA RMC Monitoring (MRP)	-	-	-	-	-	-	-	-	-	-	2	2	2	2	1	1	1
POC Loads Monitoring	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Surface Water Ambient Monitoring Pi	rogram	(SWAM	P)	•	•	•	•	•	•	•	•	•	•	•	•		
Region 2 (SF Bay Region) Monitoring	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Statewide Stream Pollution Trends (SPoT) Program ¹	-	-	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
PRISM Grant Program	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Clean Estuary Partnership (CEP)																	
Urban Pesticide Monitoring Project	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals	3	1	2	2	1	1	1	1	1	1	3	3	3	3	2	2	2

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

¹ SPoT data are only available through 2016.



Figure 4-2. Bifenthrin concentrations in bedded sediment collected from San Mateo County urban creeks from 2004 to 2018. The 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



Figure 4-3. Cyfluthrin concentrations in bedded sediment collected from San Mateo County urban creeks from 2002 to 2018. The 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.



Figure 4-4. Cypermethrin concentrations in bedded sediment collected from San Mateo County urban creeks from 2002 to 2018. The red line is the adverse effects concentration (i.e., LC₅₀) for *Hyalella azteca* (Weston et al. 2013). Only samples with concentrations above the detection limit are included



Figure 4-5. Permethrin concentrations in bedded sediment collected from San Mateo County urban creeks from 2002 to 2012. The red line is the adverse effects concentration (i.e., LC_{50}) for *Hyalella azteca* (Amweg et al. 2005). Only samples with concentrations above the detection limit are included



Figure 4-6. Fipronil concentrations in bedded sediment collected from San Mateo County urban creeks from 2013 to 2018. The orange 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 4-7. Fipronil sulfide concentrations in bedded sediment collected from San Mateo County urban creeks from 2013 to 2018. The orange 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 4-8 Fipronil sulfone concentrations in bedded sediment collected from San Mateo County urban creeks from 2013 to 2018. Orange 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 San Mateo County 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 fresh water creeks. *Hyalella 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 San Mateo County 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.

	Data Points Collected in San Mateo Urban Creeks per Year																
Monitoring Program	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
SMCWPPP Monitoring Program																	
Pre-MRP Monitoring	-	4	6	2	6	-	-	-	-	-	-	-	-	-	-	-	-
BASMAA RMC Monitoring (MRP)	-	-	-	-	-	-	-	-	-	-	4	5	4	4	1	1	3
POC Loads Monitoring	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Surface Water Ambient Monitoring Pi	rogram	(SWAM	P)														
Region 2 (SF Bay Region) Monitoring	2	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Statewide Stream Pollution Trends (SPoT) Program ¹	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PRISM Grant Program	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Clean Estuary Partnership (CEP)																	
Urban Pesticide Monitoring Project	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals	2	14	6	3	7	0	0	0	0	0	4	6	4	4	1	1	3

Table 4-3. Number of water samples collected from San Mateo County urban creeks and analyzed for toxicity to *C. dubia* from 2002 to 2018.

Figure 4-9 shows that toxicity (assessed by the two-tiered approach) to *Ceriodaphnia dubia* was not observed in water samples collected from San Mateo County urban creeks from 2002 to 2018. 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 pesticides.

Toxicity tests in water using *Chironomus dilutus* (which is sensitive to neonicotinoids) conducted by SMCWPPP in 2016 – 2018 also did not show acute toxicity using the two-tiered approach.



Figure 4-9. Numbers of water samples collected from San Mateo County urban creeks from 2002 to 2016 that didn't exhibit or did exhibit acute toxicity to *Ceriodaphnia dubia*.

4.3.2. Toxicity in Sediment

Table 4-4 summarizes the numbers of sediment samples collected in San Mateo County 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.

	Data Points Collected in San Mateo Urban Creeks per Year																
Monitoring Program	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
SMCWPPP Monitoring Program																	
Pre-MRP Monitoring	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BASMAA RMC Monitoring (MRP)	-	-	-	-	-	-	-	-	-	-	2	2	2	2	1	1	1
POC Loads Monitoring	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Surface Water Ambient Monitoring P	rogram	(SWAM	P)													<u></u>	
Region 2 (SF Bay Region) Monitoring	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Statewide Stream Pollution Trends (SPoT) Program ^{1, 2}	-	-	-	-	-	-	1	1	1	1	1	1	1	1	1	1	1
PRISM Grant Program	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Clean Estuary Partnership (CEP)																	
Urban Pesticide Monitoring Project	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals	0	1	1	1	0	0	1	1	1	1	3	3	3	3	2	2	2

Table 4-4. Number of sediment samples collected from San Mateo County urban creeks and analyzed for toxicity from 2002 to 2018.

¹ SPoT data are only available through 2016.

² In 2011 and 2013-2015, the SPoT program conducted *H. azteca* testing at standard temperate (°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.

Figure 4-10 illustrates the number of bedded sediment samples collected from San Mateo County urban creeks from 2002 to 2018 that were considered toxic to the test organism *Hyalella azteca* using the two-tiered approach. In 2011 and 2013-2015, the SPoT program analyzed sediment samples for *H. 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 10. The 2011 and 2014 acute toxicity findings shown in Figure 10 are from the samples tested with the lower temperature treatment. The same samples did not exhibit toxicity using the standard temperature method. Based on the results shown in Figure 10, it appears that sediment toxicity to *Hyalella azteca* has decreased since monitoring began in 2003.

Toxicity tests in sediment using *Chironomus dilutus* conducted by SMCWPPP in 2016 – 2018 and the SPoT program in 2015 and 2016 also did not show acute toxicity using the two-tiered approach.



Figure 4-10 Sediment samples collected from San Mateo County urban creeks from 2002 to 2018 that didn't exhibit or did exhibit significant acute toxic to *Hyalella azteca*.

4.4. Statewide Review of Pesticide and Toxicity Monitoring Data

A recent statewide review compiles and summarizes chemistry data from monitoring performed in urban areas of California (including the San Mateo Creek and San Francisquito Creek in San Mateo County and other creeks in the greater 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. The California Department of Pesticide Regulation (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 USEPA 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 SMCWPPP in compliance with the MRP.

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%, closely followed imidacloprid as the third-most frequently detected insecticide. 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 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, San Mateo County MRP Permittees have been implementing pesticide toxicity control programs since 2003. The sections below summarize the improvements to IPM programs made by Permittees in about the last five years, and enhancements that are planned for the next permit term.

5.1. Town of Atherton

Improvements to IPM Practices in the Last Five Years

The Town made several improvements to its weed management practices, including the increased use of mulch in landscape and open space areas, manual weed removal whenever practical, and implementation of practices that contribute to turf vigor, such as proper mowing, fertilization, thatch removal, aeration, and switching from a day- based schedule to a need- based irrigation schedule using evapotranspiration rates. The healthy turf out-competed weeds and reduced the establishment of weed species, thereby reducing the use of herbicides.

The Town enhanced staff training on IPM. Staff now receive the Town's IPM program information and other related topics (i.e. protecting pollinators) annually in the Pesticide Worker Safety Training.

Enhancements to IPM Practices Planned for the Next Permit Term

The Town of Atherton plans to increase supervision of contractors to ensure compliance with its IPM policy. The Town plans to require its maintenance contractors to submit monthly and annual reports summarizing their IPM efforts to control pests in the Town's landscape, park, urban forest, and natural areas. The Town plans to require that contractors use pesticides only after monitoring indicates they are needed according to established IPM thresholds. Treatments will be made with the goal of removing only the target organism. Pest control materials will be selected and applied in a manner that minimizes risks to human health, beneficial and non-target organisms, and the environment.

The Town's staff plans to perform site inspections throughout the month to assess the condition of the area, and the maintenance contractor's efforts to control pests. To ensure implementation of IPM practices, staff plans to review the maintenance contractor's billing summaries, monthly written inspection reports, and recommended remediation.

5.2. City of Belmont

Improvements to IPM Practices in the Last Five Years

The City of Belmont updated its SOPs to require all Park Department employees to obtain a Qualified Applicator Certification (QAC) within the first year of employment. The City also increased IPM training for City staff. The City stopped using bait in its buildings and facilities, and requires all contractors to use mechanical traps rather than bait. The City no longer allows the use of herbicides with a designation of "Caution" and "Danger." In 2019, the City of Belmont decided to stop using glyphosate and is exploring non-toxic alternatives.

Enhancements to IPM Practices Planned for the Next Permit Term

The City of Belmont plans to update its IPM policy in the first two years, and ensure that staff receives information on the IPM policy at the annual QAC training.

5.3. City of Brisbane

Improvements to IPM Practices in the Last Five Years

The City of Brisbane increased its outreach and supervision of contractors to ensure compliance with its IPM policy. The City sends letters to contractors at the beginning of each year to remind them about the City's IPM policy. The City's maintenance team leader monitors contractors on each project. Through conversations with its contractors, the City confirms that the contractors adhere to the policy.

Since FY 2014-15, the City has been implementing preventive actions at its corporation yard, such as sealing holes and gaps, and trapping. The City's standard procedure for weed management is to mow/pull weeds, mulch, then monitor weed growth.

Enhancements to IPM Practices Planned for the Next Permit Term

The City of Brisbane plans to create pesticide free parks and buildings, and may update its IPM Policy and SOPs to reflect any needed changes. The City plans to continue to monitor contractors for compliance with the IPM Policy.

5.4. City of Burlingame

Improvements to IPM Practices in the Last Five Years

The City implemented several IPM techniques to manage weeds, such as using mulch (generated from tree work) to suppress weeds, spot spraying of weeds, implementing cultural practices on athletic fields, such as aerating, fertilizing, over-seeding and composting to increase health of grass and discourage weeds, and creating denser landscapes by adding more plant material to eliminate bare dirt. The City enacted a policy to stop spraying weeds in the City's alley ways, and requires the use of mechanical methods for removing excessive vegetative growth.

Due to the potential negative health effects associated with glyphosate, the City has chosen to not use glyphosate in public parks or City facilities, and opted for organic alternatives. The City provided additional trainings to increase staff awareness on how to manage pests without glyphosate.

The City restructured its current rodent control contract to reduce the number of bait stations being placed near creeks and streams. Each year the maintenance team selectively reduced the number of stations by 50 units.

Enhancements to IPM Practices Planned for the Next Permit Term

The City of Burlingame plans to continue to modify pest management practices to support IPM. The City plans to monitor the effectiveness of mechanical weed removal and organic chemical applications, and update its IPM policy to require the use of more non-pesticide approaches. Additionally, the City staff

plans to evaluate pesticide applications better through a work and asset management software called Cartegraph.

By FY 2020-21 the City will have removed 100 bait stations from the field. The City plans to continue to reduce the number of units down to the minimal effective amount necessary to control the rodent population.

5.5. Town of Colma

Improvements to IPM Practices in the Last Five Years

The Town of Colma began requiring landscape contractors to submit records of IPM practices and pesticide use on the SMCWPPP Pesticide Tracking spreadsheet. To ensure that IPM techniques are being implemented, Town staff routinely reviews reports submitted by pest control contractors. The Town incorporated several non-chemical approaches to managing pests, such as, monitoring for pests, mowing weeds, mulching, preventative actions, and use of baits and traps. Pesticides of concern have not been used since FY 2014-15. The Town has voluntarily suspended the use of glyphosate until further notice. Colma provided information on IPM to staff at annual local tailgate meetings. The Town updated contract language and made changes to contractor hiring and management procedures to facilitate data collection from contactors.

The Town started using the SMCWPPP Pesticide Tracking spreadsheet to track pesticide usage, amount of the active ingredients, and location of application during this past permit period.

Enhancements to IPM Practices Planned for the Next Permit Term

In the next permit term the Town of Colma plans to update its IPM policy and procedures; The Town plans to provide enhanced staff training on updates to the Town's IPM Policy. Town staff are also planning to conduct IPM educational outreach to residents. The Town plans to continue to explore alternative methods and materials to treat weed abatement issues.

The Town plans to attach IPM policy to all landscape contracts (POs / Work Orders) to ensure that contractors are aware of it.

The Town plans to improve/ provide outreach to contractors/ vendors by letting them know about local Bay Friendly Training, IPM training/ workshops, and communicating improved practices to contactors.

5.6. Daly City

Improvements to IPM Practices in the Last Five Years

The City of Daly City created a pesticide-free building that houses the child care center at City Hall. The City uses several IPM techniques to manage pests, such as line trimming weeds and mulching, removing plants that require frequent pesticide applications, and replacing invasive plants with native plants. Daly City is piloting alternate new products to replace glyphosate, and purchased a line mower to provide more mechanical support to weed control. The City attaches its IPM policy to all landscape contracts to ensure that contractors are aware of it. Daly City also includes IPM information in its annual pesticide training for all Parks Department staff.

Enhancements to IPM Practices Planned for the Next Permit Term

In the next permit term, the City will invest in new maintenance management software to track work performed as well as pesticide usage. This will help the City better analyze its pest management practices, and identify opportunities for implementing IPM, including reducing pesticide use. Daly City will also ensure that the Public Works Supervisor and Maintenance Leads attend all IPM trainings held by SMCWPPP.

5.7. East Palo Alto

Improvements to IPM Practices in the Last Five Years

In the past five years, the City of East Palo Alto implemented a pesticide-free building program. The City updated its IPM Policy, modified pest management practices to support IPM, updated pesticide tracking system, created policies restricting the use of certain pesticides on municipal properties (i.e., buildings, parks, rights-of-way,) enhanced staff trainings on IPM, updated hiring processes for contractors that apply pesticides to ensure compliance with IPM Policy, increased supervision of contractors to ensure compliance with IPM Policy, and improved outreach to pest control professionals.

Enhancements to IPM Practices Planned for the Next Permit Term

The City of East Palo Alto plans to create a pesticide-free park program and increasing outreach to residents. The City plans to conduct an outreach program for residents about pesticide alternatives and the proposed pesticide-free park program in the first year of the permit term, and work on developing pesticide-free parks in the next permit term.

5.8. Foster City

Improvements to IPM Practices in the Last Five Years

Foster City began using the SMCWPPP Pesticide Tracking spreadsheet to track pesticide usage, amount of the active ingredients, and location of application. The City worked with a Pesticide Control Advisor (PCA) to provide IPM information at tailgate meetings and the City's mandatory annual pesticide training. As an incentive, the City offers an annual Certification Pay to employees that hold a current Qualified Applicator Certification (QAC) or Qualified Applicator License (QAL).

Enhancements to IPM Practices Planned for the Next Permit Term

In the next permit term, Foster City plans to create policies that restrict the use of certain pesticides on municipal buildings, parks, and in public right of ways. The policies will likely be implemented within the next 2 to 3 years. The City plans to evaluate its current practices with pre-emergent herbicides with the goal of reducing its overall use of post-emergent products.

The City plans to offer an additional incentive for staff to obtain a QAC or QAL. A Maintenance Worker 1 will be automatically promoted to a Maintenance Worker 2 position when the employee obtains a QAC or QAL. Previously the employee had to wait until a Maintenance Worker 2 position became available. The City also plans to hire firms to provide in-house trainings and seminars to assist with continuing education requirements, including IPM trainings, needed to maintain the QAC.

5.9. Half Moon Bay

Improvements to IPM Practices in the Last Five Years

The City prefers mechanical approaches to weed control instead of the use of pesticides. In 2019, the City of Half Moon Bay stopped using any glyphosate products such as Roundup. The City is currently revisiting its usage, and plans on having a formal policy in place later this year.

The City uses traps instead of broadcast pesticides and takes preventative measures such as sealing holes and gaps in structures and improving sanitation to address pest issues.

The City of Half Moon Bay began using rented goats to assist with the City's weed and fire abatement programs. The goats have been used to great success and with the backing of local residents. Goats are ideal for weed abatement because they eat many weeds, helping the City avoid using herbicides. Goats are able to graze large city-owned parcels quickly and with relative ease. The goats are not allowed into any areas that are considered sensitive habitat. The amount grazed by goats each year is significant.

Tailgate meetings are used to provide IPM information and training on the IPM policy and standard operating procedures.

Enhancements to IPM Practices Planned for the Next Permit Term

In the next permit term the City of Half Moon Bay plans to update its IPM policy, and provide enhanced staff training on any policy and/or operational changes. The City is exploring alternative methods and materials to manage weeds, and will work with SMCWPPP to improve IPM policies and procedures around this issue. Continuous improvement is anticipated throughout the next permit term. Policy adjustment will require feedback from City Council.

In addition, the City plans to update its contact language and make changes to contractor hiring and management procedures to facilitate data collection from contractors. The City plans to attach the IPM policy to all landscape contracts (e.g., Purchase Orders and Work Orders) to ensure that contractors are aware of it.

The City also plans to improve outreach to contractors and vendors. For example, the City plans to let contractors know about local Bay Friendly training opportunities, IPM training events and workshops, and will communicate improved practices to contractors.

5.10. Town of Hillsborough

Improvements to IPM Practices in the Last Five Years

The Town of Hillsborough updated its IPM Policy in 2019. The Town implemented several non-chemical pesticide management strategies such as monitoring, mowing weeds, and mulching. Hillsborough removed plants that require frequent pesticide applications, and replaced invasive plants with native species. The Town used baits and traps instead of broadcast pesticides, and took preventative measures such as sealing holes and gaps in structures, and improving sanitation. The Town held tailgate meetings to train staff on the IPM policy and IPM SOPs.

Hillsborough made significant improvements to its contractor hiring and management procedures. The Town's IPM Policy is now included in all contract documents (e.g., RFP and specifications). Hillsborough also updated contract specifications to include a requirement that contractors not use pesticides of concern. Contractors are now required to implement preventative measures in areas prone to pests to deter them. For example, they remove tule plants from water bodies to prevent frogs from reproducing.

The Town increased supervision of contractors to ensure compliance with IPM policy with routine meetings, phone calls, and emails. The Town and the pest control contractor meet in person yearly to review the Town's IPM policy and discuss how to comply with this policy. Contractors are required to obtain Town staff's approval before applying pesticides, and submit documentation describing the IPM techniques that were implemented. If needed, Town staff conducts field visits to confirm the use of IPM methods. Monthly reports are provided to the Town with a summary of the inspections made, products used, and recommendations.

Enhancements to IPM Practices Planned for the Next Permit Term

In the next permit term the Town of Hillsborough plans to enhance staff training with more information on the Town's IPM Policy. Town staff are also planning to conduct IPM outreach to residents.

5.11. City of Menlo Park

Improvements to IPM Practices in the Last Five Years

The City of Menlo Park updated its IPM Policy in 2015. In April 2017, the City began implementing an herbicide-free program at City parks. Weeds are now hand-pulled, and areas are mulched to inhibit weed germination.

Enhancements to IPM Practices Planned for the Next Permit Term

The City of Menlo Park plans to provide additional IPM training to parks and facilities maintenance staff.

5.12. City of Millbrae

Improvements to IPM Practices in the Last Five Years

The City of Millbrae focused on weed management, and increased the use of wood chips for weed control. The City converted the Millbrae City Hall landscape to xeriscape. The City began requiring contractors to obtain permission from City staff before applying pesticides.

Enhancements to IPM Practices Planned for the Next Permit Term

The City of Millbrae plans to improve outreach to residents, including conducting a workshop for residents to educate them on IPM and alternatives to pesticides.

5.13. City of Pacifica

Improvements to IPM Practices in the Last Five Years

The City of Pacifica created pesticide-free areas, and restricted the use of glyphosate on municipal properties. The Public Works Department significantly reduced the use of glyphosate for weed control, and is relying on increased use of mechanical weeding with mowers and weed-whackers.

Enhancements to IPM Practices Planned for the Next Permit Term

The City of Pacifica plans to create policies restricting the use of certain pesticides on municipal properties, and investigate the use of different mechanical weed control options. The City is developing a weed control plan to address areas where it is difficult to manually remove vegetation. The plan may include the rental or purchase of additional machinery, such as bigger brush mowers with tracks for off road work, and smaller mowers to replace weed whackers.

5.14. Town of Portola Valley

Improvements to IPM Practices in the Last Five Years

To eliminate the use of rodenticides on Town property, the Town funded and implemented a pilot program on two of its sports fields. The pilot program used mechanical trapping methods for gophers. Following the success of the pilot program, the Town implemented trapping methods at all Town owned properties and sports fields, and stopped the use of rodenticides. Portola Valley stopped the application of pre and post-emergent spraying of weeds on all trails, and also stopped spraying along roads.

Enhancements to IPM Practices Planned for the Next Permit Term

Portola Valley is a small rural town, and there are limited opportunities for additional actions. In the next permit term the Town of Portola Valley plans to enhance staff trainings, and increase supervision of contractors to ensure compliance with the Town's IPM Policy. The Town will continue to implement IPM practices.

5.15. City of Redwood City

Improvements to IPM Practices in the Last Five Years

The City of Redwood City began using the SMCWPPPP pesticide tracking spreadsheet. The City enhanced staff trainings, increased supervision of contractors that apply pesticides to ensure IPM policy compliance, and modified pest management practices. Two notable modified practices are the use of more mechanical controls for fire control, and testing additional organic pesticides for weed abatement.

Enhancements to IPM Practices Planned for the Next Permit Term

The City plans to continue to modify pest management practices with a focus on finding alternative methods and materials to treat weed abatement issues. For example, City staff plans to continue to investigate mechanical means of weed abatement to replace chemical treatments, and modify terrain (i.e., move large rocks) to accommodate brush mowers or other attachments for removal and access. In FY 2019-20, the City plans to gather data on current methods used, and consult with neighboring jurisdictions on its practices for similar areas. In FY 2020-21, the City plans to pilot the modified pest management practices at specific test sites, followed by a review of the modified practices for effectiveness in FY 2021-22. The City plans to roll out modified practices City wide in FY 2022-23.

5.16. City of San Bruno

Improvements to IPM Practices in the Last Five Years

In the past five years, the City of San Bruno has lowered its use of pesticides in parks and moved to more manual removal of weeds.

Enhancements to IPM Practices Planned for the Next Permit Term

The City of San Bruno plans to discontinue the use of glyphosate on City properties, and plans to train employees on alternatives methods of weed control.

5.17. City of San Carlos

Improvements to IPM Practices in the Last Five Years

The City of San Carlos created two pesticide free parks, Vista Park and Cedar Park. The City created policies that suspended the use of use of glyphosate in all developed parks. The City provided tailgate staff trainings on IPM. The City increased supervision of contractors to ensure compliance with IPM Policy.

Enhancements to IPM Practices Planned for the Next Permit Term

In the next five years, the City of San Carlos plans to explore creating additional pesticide-free parks.

5.18. City of San Mateo

Improvements to IPM Practices in the Last Five Years

In 2017, the City of San Mateo updated its IPM SOPs and hiring processes for contractors that apply pesticides to ensure compliance with the IPM Policy. The City revised the "Structural Pest Control Services", and "Landscape Pest Control Services" Scopes of Work used in soliciting bids from contractors to include up-to-date IPM requirements. These included updates to the list of prohibited products, which increased from the previous permit.

In April 2019, the City ceased to use glyphosate containing products, and plans to explore alternatives in the coming year.

The City revised Monthly IPM Reporting Forms for its contractors. The revision included a listing of products that are not allowed for application under the City's IPM policy, and added that emergency applications may only occur with the Project Manager's authorization. As of 2019, the Parks and Recreation Department sends monthly application reports to the Environmental Services Division for addition to the appropriate tracking folders for the current fiscal year. Parks and Recreation submit these reports regardless of whether or not there were any applications for that month. Tracking pesticide use has increased from once a year reporting, to once a month within the City.

In FY 2018-19, the Stormwater Coordinator and Environmental Compliance Inspector began shadowing individuals from the City's pest control contractor to ensure compliance with the IPM policy. The City worked with its pest control contractor to gain access to the contractor's internal web-based tracking

database. This makes it possible for the City to review its service reports at any time. These reports include information on pesticides used, the amounts, and areas and dates serviced.

The City hired a Stormwater Coordinator in January 2017, whose responsibilities include oversight of IPM implementation. The Stormwater Coordinator trains park maintenance staff on IPM, assists with the renewal and management of pest management contracts, and actively monitors contractors by conducting field visits and reviewing records.

Enhancements to IPM Practices Planned for the Next Permit Term

The City is in the process of hiring an Environmental Compliance Coordinator (ECC) whose responsibilities will include monitoring IPM progress and initiatives, identifying areas in need of improvement, developing solutions, and ensuring ongoing compliance.

The City plans to review current practices and update internal policies and procedures and maintenance agreement contract templates, if needed. The City plans to evaluate its record collection, review, and retention practices to ensure thorough and adequate oversight of all City staff and contractors tasked with pesticide application or pest management practices.

The City plans to evaluate current pest management practices, and incorporate least-toxic products and practices, wherever possible. The City plans to evaluate the effectiveness of these practices, and incorporate them into contracts and in-house policies, as needed.

The City plans to improve outreach to residents through use of social media and other messaging opportunities to the maximum extent practical. Public Works recently hired a Communications and Public Relations Analyst specializing in public outreach who can be utilized to provide outreach on IPM and other stormwater issues.

5.19. County of San Mateo

Improvements to IPM Practices in the Last Five Years

In the last five years, the County's Facilities, Maintenance and Operations Section reinforced the idea of less (or no) spraying of pesticides unless no other option is available. Its pest control vendor used more bait stations and traps and less spraying. The County's landscapers use very little, if any, pesticides. The County forwarded new information, as well as workshops and trainings on the subjects, to its contractors to keep them up to date on new policies and ideas. The County worked closely with the contractors and provided them tracking tools for their pesticide usage.

As part of the Parks Department, the Natural Resource Management Program (NRM) oversaw contractors using herbicides in natural areas within park properties. These contractors are required to track all areas of their work using an application via smartphone, tablet, or a web-based portal. The application requires delineation of an area treated and the amount of herbicide used per treatment date and polygon. All NRM contractors are now briefed on the County's current IPM policy and provided training on how to use the application described above. NRM staff regularly checks up on contractors performing herbicide work and uses the data collected in the app to improve reporting. For larger

projects, NRM staff provide public outreach concerning the use of herbicides and provide information and education about the approach and address potential concerns of residents.

Enhancements to IPM Practices Planned for the Next Permit Term

Throughout the next permit term, the County plans to work with its contractors to improve IPM practices and reduce the use of pesticides. The NRM team will provide training to the ranger staff on IPM and alternatives to herbicide use in our parks. In 2020, an updated IPM training module will be developed for current staff. In 2021, a new module will be developed for all new hires.

5.20. San Mateo County Flood Control District

Improvements to IPM Practices in the Last Five Years

Though the San Mateo Flood Control District (District) does not routinely apply herbicides at the Countymaintained flood control facilities, the District continued to improve pest management practices to support IPM. District and County staff perform vegetation maintenance within the San Bruno Creek Flood Control Zone with the use of non-chemical strategies such as removal with hand tools and/or weed whacking. The District also contracted with a landscape/restoration consultant for on-going maintenance of several mitigation sites within the Colma Creek Flood Control Zone. Work performed by the contractor at the mitigation sites involved the use of non-chemical strategies such as hand weeding and mechanical removal, mulching, and replacing invasive plants with native plants. The District performed minor channel maintenance activities within the Colma Creek Flood Control Zone, including limited vegetation management as part of the Colma Creek Channel Maintenance Project. Vegetation management work has included the removal of pampas grass in a targeted area adjacent to Colma Creek, and removal of other weedy vegetation at pipe outlets and joints within the concrete-lined channel and banks in the upper reach of Colma Creek. The majority of channel vegetation maintenance involves the use of non-chemical strategies such as mechanical and hand removal. Small amounts of herbicide may be used where needed to treat invasive pampas grass root balls.

The District worked closely with contractors to ensure compliance and increased its supervision of contractors to ensure compliance with the District's IPM policy. For the Colma Creek Channel Maintenance Project and mitigation site maintenance, the District issued task specific authorizations for agreed upon work, provided detailed memos and e-mails summarizing permit conditions, BMPs, and IPM policy, and closely monitored the work with a County biologist.

Enhancements to IPM Practices Planned for the Next Permit Term

In the next permit term, the District plans to continue with improvement of pest management practices to support IPM, and communicating improved practices to contactors. The District will continue to closely supervise contractors.

5.21. South San Francisco

Improvements to IPM Practices in the Last Five Years

The City of South San Francisco conducted enhanced pesticide safety, calibration and appropriate chemical use trainings, hosted by a Pesticide Control Advisor (PCA). As a result, five City staff hold

Qualified Applicator Certification (QAC) or higher level licenses. Staff are also trained as Bay-Friendly Landscape Professionals.

The City has implemented use of pre-emergents on right-of-way (ROW) and median areas to reduce manual labor and reduce future seed banks. This has resulted in less post-emergent herbicide applications, such as glyphosate-containing products.

The City purchased a new remote-controlled slope flail mower that allows for weed abatement to be performed in areas that are generally unsafe for employees to access. Additionally, this tool has increased efficiency dramatically when working in open space and ROW areas.

South San Francisco also implemented cultural practices of increasing use of recycled tree mulch, from our internal tree crew, and applying these in areas to suppress weeds and increase soil health where possible.

The City also plants non-invasive species that out compete weed species and focuses on choosing plants that are not host to damaging insects/disease or potentially vector insects/diseases, e.g., *Phytophthora ramorum*, Polyphagous shot hole borer (PSB), and Glassy-winged Sharpshooter.

The City has also focused on removing Monterey Pines at first signs of attack from Red Turpentine Beetle (RTB) or other boring beetles that spread Pitch Canker. These insects that are a vector for Pitch Canker in Pines, are responsible for the deaths of many pines throughout the Peninsula and state in general. Removing trees at the early stages of attack helps reduce insect numbers so they cannot nest and reproduce, further spreading the disease.

Enhancements to IPM Practices Planned for the Next Permit Term

The City of South San Francisco plans to update its IPM policy in FY 2020-21. The City plans to adopt an Urban Forest Master Plan and revise its approved tree list to help promote canopy coverage and support urban wildlife and insects.

The City intends to increase use of "pollinator garden" type landscape plantings to provide pollinator corridors throughout the city to connect the Coastal Range with Sign Hill and San Bruno Mountain, and attract beneficial insects.

5.22. Woodside

Improvements to IPM Practices in the Last Five Years

The Town of Woodside modified pest management practices to support IPM. Last year, after the State of California listed glyphosate as a Prop 65 chemical, the Town banned the use of glyphosate at all Town facilities.

Enhancements to IPM Practices Planned for the Next Permit Term

The Town of Woodside will continue to focus on implementing IPM practices, and provide enhanced staff training on any policy and/or operational changes. The Town will incorporate updates to the IPM Policy via Town Council resolutions.

6.0 CONCLUSIONS

Through the development of this pesticide source control effectiveness evaluation report, San Mateo County Permittees 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 improvements to Permittee IPM programs in the last five years; and
- Describing improvements planned during the next Permit term.

This section summarizes the conclusions of the evaluation, including source control measures that SMCWPPP and San Mateo County municipal agencies are continuing to implement and planned enhancements to assist in achieving targets for pesticide concentrations and pesticide-related toxicity in San Mateo County urban creeks.

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

SMCWPPP and San Mateo County municipal 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 3.0). For example, the following Level 1 through 4 outcomes have been achieved as a result of control measure implementation:

- All San Mateo County Permittees have adopted IPM policies/ordinances and established pesticide application SOPs. All municipal staff that apply pesticides receive training on the IPM policies. IPM policies and pesticide programs have led to an increase in awareness about pesticide impacts and changes in behavior by municipal employees and contractors. San Mateo County Permittees are either not using pesticides of concern, or using them in minimal quantities, and generally only as a last resort.
- All San Mateo County Permittees that use contractors to apply pesticides have either 1) hired contractors that are IPM-certified and/or have taken the Bay-Friendly Landscaper Training or 2) have contract specifications in place that require contractors to follow their IPM policies. Of the 20 agencies that hire pest control contractors, 17 require that contractors obtain permission from municipal staff before making any pesticide applications.
- SMCWPPP implements the OWOW program in local retail stores and nurseries to provide lesstoxic pest control information to residents at the point-of-purchase. From FY 2013-14 through FY 2017-18, SMCWPPP sponsored 44 store employee trainings and trained 390 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.

- San Mateo County Permittees have ensured that adequate pesticide disposal services are available to all residents and small businesses in San Mateo County by participating in the in the San Mateo County Health Department's HHW Program and VSQG Business Collection Program. The HHW and VSQG Programs help reduce the amount of pesticides available as a potential source to urban runoff. For example, in both FY 2016-17 and FY 2017-18, the HHW Program managed more than 94,000 pounds of poisons (including pesticides) per year.
- SMCWPPP's other various efforts to educate residents about pesticides and IPM, including media
 advertising, website postings and distribution of outreach materials at events, raise awareness
 and lead to increased use of IPM and decreased use of toxic pesticides. Information on less-toxic
 pest control is posted on SMCWPPP's website (flowstobay.org), which includes a webpage
 dedicated to helping the public find IPM certified contractors (flowstobay.org/IPMPCO). To-date,
 seven IPM certified contractors have agreed to be listed on the new webpage. SMCWPPP has also
 conducted targeted outreach to structural PCOs on IPM.
- SMCWPPP is continuing to educate pest control professionals on IPM and water quality issues by sending them informational letters annually.
- As a result of SMCWPPP and Permittee efforts to reduce pesticide use at new development and
 redevelopment sites, project developers are continuing to use sustainable landscaping practices in
 development projects. These practices reduce pesticide use by encouraging pest-resistant
 landscaping and design features in the design, landscaping, and environmental reviews of
 proposed development projects. Project designs that use efficient irrigation systems to minimize
 runoff are also encouraged.
- All Permittees have made significant improvements to their IPM programs in the last five years (see Section 5 for more details). Figure 6-1 provides an overview of the types of improvements made and the number of agencies that made each improvement. The enhancements most commonly reported by Permittees were changing their pest management practices to incorporate IPM, updating their IPM Policy or SOPs, and enhancing staff trainings to incorporate information on IPM.



Figure 6-1. Summary of Improvements Made to San Mateo County Permittee IPM Programs from FY 2013-14 to FY 2018-19.

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 samples from San Mateo County urban creeks. SMCWPPP has monitored urban creeks since the early 2000s, consistent with NPDES stormwater permit requirements, and other programs have collected additional data, as described in Section 4.0. 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 San Mateo County urban creeks. From 2002 to 2012, diazinon concentrations have been well below the TMDL/WQAS target (i.e., 100 ng/L). In addition, toxicity to *Ceriodaphnia dubia* (i.e., Toxicity Units > 1.0) was not observed in water samples collected from San Mateo County urban creeks from 2002 to 2018. 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 these organophosphate pesticides.
- Pesticides that have gained market share during the past decade (e.g., pyrethroids, fipronil, imidacloprid) are a potential concern in San Mateo County urban creeks. However, based on the limited sediment chemistry data compiled, pyrethroid concentrations and related toxicity may be declining. TOC-normalized concentrations of pesticides in sediment samples appear to have decreased since 2012 for pyrethroids and since 2014 for fipronil. Furthermore, with the exception of two bifenthrin samples (one collected in 2004 and the other in 2016), concentrations of these pesticides did not exceed adverse effects thresholds. In 2002 to 2012, 60% (6 of 10) of the bedded sediment samples collected from San Mateo County urban creeks were acutely toxic to the test organism Hyalella azteca (an organism known to be sensitive to pyrethroids); whereas, only 7% (1 of 15) of the bedded sediment samples collected from 2013 to 2018 were acutely toxic to Hyalella azteca. Statewide, pyrethroids such as bifenthrin are still the most widely detected pesticides and are considered to be the leading cause of pesticide-related toxicity in urban areas (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 San Mateo County.

7.0 NEXT STEPS

In follow-up to this pesticide source control effectiveness evaluation, SMCWPPP and San Mateo County Permittees plan to continue implementing and enhancing pesticide source control measures, in an effort to not only reduce the impacts of current pesticides of concern, but also to reduce the risk of future pesticides types from impacting San Mateo County creeks and 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 San Mateo urban creeks.

7.1. Program Level

In follow-up to this evaluation, SMCWPPP plans to continue its multi-faceted pesticide toxicity reduction efforts described in this report. SMCWPPP's future activities will include continuing to:

- Actively Participate 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 SMCWPPP (on behalf of San Mateo County Permittees) continues its efforts to influence the pesticide approval and registration process. SMCWPPP will continue to work with CASQA to communicate to the USEPA Office of Pesticide Programs (OPP) and the California Department of Pesticide Regulation (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 USEPA actions:
 - 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 USEPA 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 USEPA 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.

- Assist San Mateo County Permittees with MRP Compliance. Through it Parks Maintenance and IPM Workgroup, SMCWPPP will continue assisting San Mateo County Permittees to comply with the pesticides toxicity reduction requirements in the MRP.
- **Conduct Outreach to Residents**. SMCWPPP will continue conducting outreach targeting San Mateo County residents who apply pesticides or hire professionals that provide pest control services.
- **Conduct Outreach to Structural Pest Control Professionals.** SMCWPPP will continue conducting outreach to structural pest control professionals in San Mateo County. This outreach may include sending informational letters and/or making educational telephone calls directly to structural pest control professionals.
- Implement Point-of-Purchase Outreach. SMCWPPP will continue working with the BASMAA IPM Store Partnership Program (*Our Water Our World*) in local retail stores and nurseries.
- **Coordinate with the County Agricultural Commissioner.** SMCWPPP will continue coordinating with San Mateo County Agriculture/Weights and Measures staff 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.
- Implement a Water Quality Monitoring Program. SMCWPPP will continue implementing its water quality monitoring program and evaluating 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 related to pesticide toxicity in urban creeks.

7.2. Permittee Level

In follow-up to this evaluation, San Mateo County Permittees plan to continue their wide-ranging pesticide toxicity reduction activities and make selected enhancements to these efforts, as described in this report and below. Future activities by Permittees will include:

- **Continuing to Implement Multi-faceted Local IPM Programs**. San Mateo County municipal agencies will continue implementing and as appropriate improving their local IPM programs to reduce the use of pesticides of concern. This will include updating IPM policies/ordinances and SOPs as needed, tracking and minimizing the use of pesticides of concern, training municipal staff, and requiring contractors to implement IPM.
- Making Specific Enhancements to Local IPM Programs. Figure 7-1 summarizes specific enhancements that Permittees plan to make to their IPM programs 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 policies/ordinances and SOPs.
- **Continuing to Provide Disposal Locations for HHW, including Pesticides.** Permittees will continue to work with the San Mateo County HHW Program to provide free pesticide disposal to residents.

• Continuing to Require New Development and Redevelopment Projects to Implement Sustainable Techniques that Reduce Pesticide Use. San Mateo County Permittees will continue to require practices that reduce pesticide use by encouraging pest-resistant landscaping and design features in the design, landscaping, and environmental reviews of proposed development projects. Project designs that use efficient irrigation systems to minimize runoff are also encouraged.



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

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