This Status Report outlines actions taken by regulatory agencies and municipal stormwater and wastewater dischargers to reduce pesticide-related toxicity in 2016 and the first half of 2017.

TMDL Summary & Strategy

In the 1990s, 37 urban creeks across the San Francisco Bay Area exceeded water quality standards for aquatic toxicity due to diazinon. Available information indicated that all Bay Area urban creeks receive pesticides through stormwater discharges and are impaired; thus, the Diazinon and Pesticide-Related Toxicity TMDL applies to all Bay Area urban creeks.

Diazinon uses were phased out in 2004, but pesticides used to replace diazinon appeared likely to cause toxicity as well. Thus, the TMDL addresses all pesticide-related toxicity (e.g. pyrethroid and fipronil toxicity).

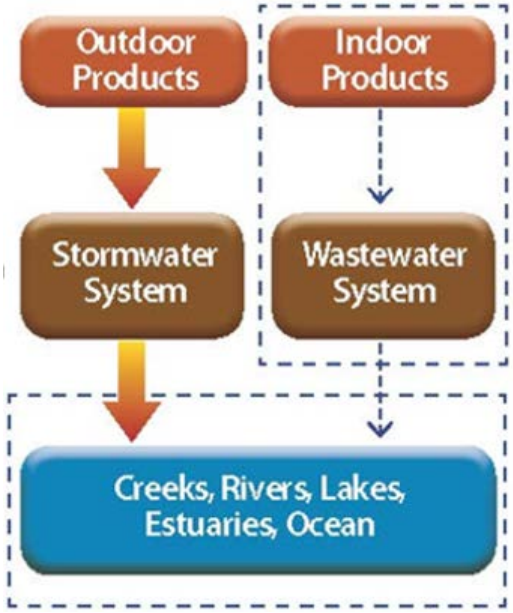
The TMDL's implementation strategy includes the many parties who bear responsibility for pesticide discharges to creeks. It focuses on three areas.

- Better coordination between pesticide and water quality agencies, for example, during pesticide regulatory actions,
- Education and outreach, and
- Research and monitoring.

The TMDL recognizes that pesticides applied properly will continue to cause water quality impairment until pesticide evaluation and registration actions more fully account for possible aquatic impacts. Currently, pyrethroids are responsible for aquatic toxicity in Kirker Creek and for toxic secondarily-treated wastewater discharges into Miller Creek. Other urban water bodies across California are also impaired by pyrethroids. Based on its toxicity and urban usage, fipronil may cause similar problems in the near future.

Regulatory Actions Taken by Pesticide and Water Quality Agencies

U.S. EPA and the California Department of Pesticide Regulation (DPR) often evaluate potential aquatic impacts of pesticides using the simple framework diagramed at right (*BACWA*). We have been working with stormwater and wastewater dischargers to improve impact assessments – for example, to include analyses of pesticide usage for sewer line root control, pet products, and treated fabrics. DPR has significantly broadened its evaluation methods in recent years (see table below).



In 2016-17, San Francisco Water Board staff worked on a statewide project with the goal of reducing pesticide-related toxicity in California's urban waters. Federal, State, and local entities have participated in this project and have taken their own actions, some of which are summarized below.

Action	Implementing Parties	Details
Establish a Statewide Framework for Urban Pesticides Reduction, a project under the California Strategy to Optimize Resource Management of Storm Water (STORMS)	• State Water Board and Regional Water Boards (San Francisco Bay, Central Coast, and Central Valley) • U.S. EPA Region 9 • DPR • Municipalities as represented by the California Stormwater Quality Association (CASQA)	Propose an amendment to the CA Inland Surface Waters & Enclosed Estuaries Plan to address pesticide-related toxicity in urban waters. Water Board staff participates and chairs the subcommittee on model stormwater permit language. The amendment would reflect the approach used in the Bay Area but would be implemented more comprehensively across the State and would coordinate water quality monitoring for pesticides.
Comment on pesticide registration and evaluation actions proposed by U.S. EPA and DPR when the pesticide under consideration could have urban water quality impacts – from stormwater runoff or wastewater treatment plant discharges	• Regional Water Boards (San Francisco Bay, Central Coast, and Central Valley) • CASQA • Bay Area Clean Water Agencies (BACWA)	San Francisco Bay Regional Water Board staff in the Planning and NPDES Divisions submitted written comments on over 16 proposed actions in the past year. BACWA has posted a regulatory plan of action, including a graphic diagram of the fate of pesticides in a sewage treatment plant.
Develop tools that incorporate water quality evaluation into pesticide evaluation, reevaluation, labeling, and monitoring efforts. These tools are improved periodically.	• DPR	Pesticide Registration Evaluation Model (Lou) – evaluates aquatic impacts of pesticide products submitted for registration. Surface Water Monitoring Prioritization Model (Lou) – prioritizes pesticides for surface water monitoring based on pesticide use & toxicity data, chemical properties and other information.

Education & Outreach

The TMDL calls for education and outreach to encourage communities to reduce their reliance on pesticides, with a focus on community members most likely to use pesticides that threaten water quality. Education and outreach is required in wastewater and stormwater permits the Water Board issues. Stormwater permits specify that outreach must include:

(1) Consumers at the point of purchase,
(2) Consumers who contract with professional pest control operators, and
(3) Pest control professionals.

Municipal stormwater and wastewater agencies have conducted such outreach for over a decade, and some outreach programs initiated in the Bay Region are growing to other areas of the State, including the successful Our Water Our World program. Outreach is done both locally (workshops, county fair booths) and regionally (green gardener program).

In addition, both DPR and the University of California IPM Program conducted outreach on Integrated Pest Management (IPM). Water Board staff also initiated and participated in outreach, including two presentations to pest control professionals in the 2016-17 timeframe.

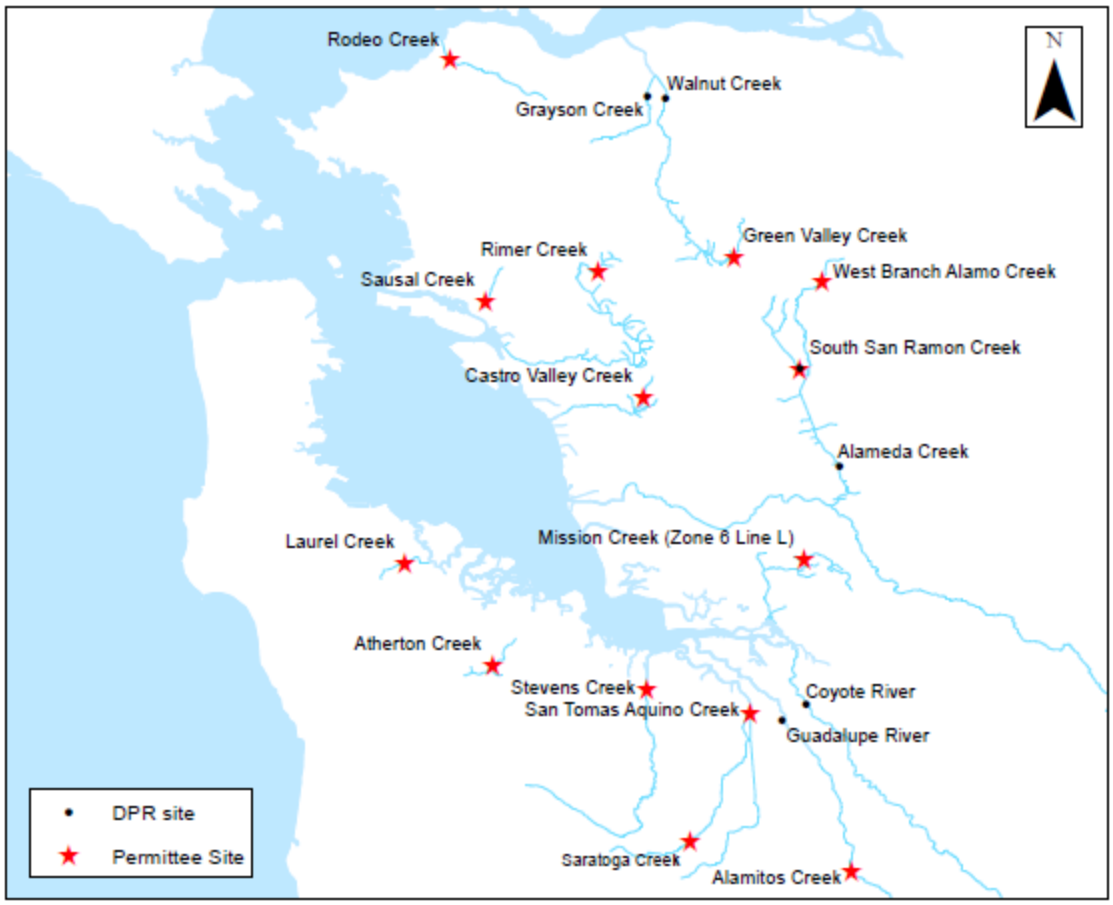
Monitoring

CREEK MONITORING: Municipal Stormwater Permittees sample their creeks for pesticides and toxicity. Creeks are monitored on a rotating basis, so year-to-year direct comparisons are not possible. Select results from Water Years 2015 and 2016 (*UCMR*) are shown below along with a map showing sample locations.

Creek	Toxic > Established Threshold?			Pesticides in Sediment at concentrations > 1 (all in ng/g)	Toxicity Units (TU) & Toxic Equivalent Concentration quotients (TEC) for Sediment. Values > 1 are deemed significant
	Wet Weather Creek Water	Dry Weather Creek Water	Dry Weather Creek Sediment		
Water Year 2015					
Castro Valley	yes, toxic to *H.azteca*[1]	no	no	Results reported together: bifenthrin 4.8 cyfluthrin 1.3 permethrin, total 1.95	sum pyrethroids TU=8.07 chlordane TEC=3.4 sum DDD TEC=1.37 sum DDE TEC=3.1
S.San Ramon	no	no	no		sum pyrethroids TU=3.15
Mission, Zone 6 Line L	no	no	no		sum pyrethroids TU=8.57 sum DDE TEC=2.04
Rodeo	yes, toxic to *H.azteca*	no	no	bifenthrin 2.7 permethrin, total 1.45	sum pyrethroids TU=0.32
Green Valley	yes, toxic to *H.azteca*	no	yes, toxic to *H.azteca*	bifenthrin 16 cyfluthrin 1.1 delta/tralomethrin 3.7 DDD(p,p') 2.8 DDE(p,p') 3.6	sum pyrethroids TU=1.11 sum DDTs TEC = 1.21
San Tomas Aquino	no	no	no	bifenthrin 2 DDE(p,p') 2.7	sum pyrethroids TU=0.85 sum DDE TEC=1.2
Saratoga	no	no	no	no result > 1	sum pyrethroids TU=0.16
Alamitos	no	no	yes, toxic to *H.azteca*	no result > 1	sum pyrethroids TU=0.32
Atherton	no	no	no	bifenthrin 2.0 chlordane 5.7, 7.1 DDD(p,p') 3.5 DDE(p,p') 3.6 permethrin total 2.3	sum pyrethroids TU=0.70 chlordane TEC=4.0
Laurel	no	no	yes, toxic to *H.azteca*	chlordane 2.6, 2.7 DDD(p,p') 4.3 DDE(p,p') 9.6	sum pyrethroids TU=0.70 chlordane TEC=1.6 sum DDD TEC=1.1 sum DDE TEC=3.4
Water Year 2016					
Castro Valley[2]	no	no	no	bifenthrin 7.4 cyfluthrin total 1.7 permethrin total 3.4	not calculated
Sausal[2]	no	no	no	bifenthrin 3.6 permethrin total 1.6	not calculated
West Branch Alamo Creek[2]	not sampled	no	no	bifenthrin 9.2 permethrin 2.8	sum pyrethroids TU = 10.6
Rimer[2]	not sampled	no	no	no result > 1	sum pyrethroids TU = 0.88
San Tomas Aquino[2]	not sampled	no	no	no result > 1	sum pyrethroids TU = 0.08
Stevens[2]	not sampled	no	no	bifenthrin 1.1	sum pyrethroids TU = 1.21
Laurel[2]	not sampled	no	no	bifenthrin 1.5 permethrin total 1.2	sum pyrethroids TU = 2.63

[1] *Results support conclusion that pesticides caused toxicity observed in 2013 upstream of this location.*

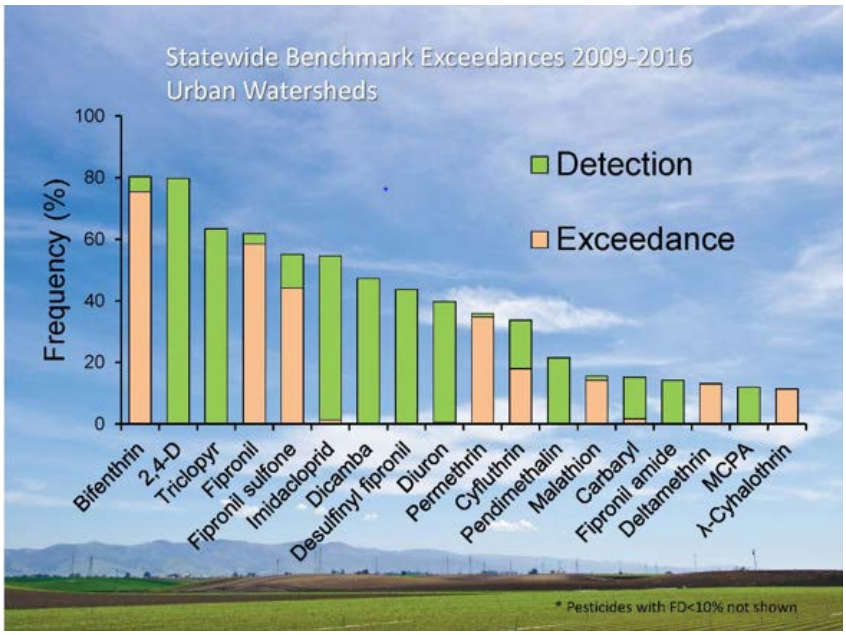
[2] *Carbaryl and fipronil were analyzed and not detected above method detection levels.*



These results demonstrate that pesticides continue to contribute to toxicity in Bay Region creeks, largely due to bifenthrin, a pesticide used commonly for ant and termite control. Also in 2016, a Contra Costa County study concluded that previously observed toxicity to *H.azteca* in Dry Creek and Grayson Creek was caused by bifenthrin and other pyrethroids. The study found that countywide urban use patterns for bifenthrin and cyfluthrin during 2013 appear dominated by several high values, and further investigation of DPR pesticide use data could be useful in determining effective mitigation measures.

DPR's surface water monitoring program has monitored urban pesticide runoff since 2008. Selected results are shown in the chart below. In 2015 and 2016, DPR monitored Grayson Creek; Martin Canyon Creek; Guadalupe River and Coyote Creek; and South San Ramon Creek. Highlights of the results, which include data from urban Sacramento, include:

- Pesticide water pollution and toxicity were found in almost all of the urban watersheds monitored.
- Bifenthrin was detected in 83% of samples, generally at concentrations higher than its minimum U.S. EPA benchmark.
- Fipronil was also commonly detected, at a frequency of 29%.
- The herbicide 2,4-D was detected in 93% of samples, but at concentrations below its minimum U.S. EPA benchmark.
- Over a longer timeframe, DPR monitoring has found imidacloprid to be a commonly-detected insecticide, especially in urban Orange County (*Ensminger 2012*). Both DPR and stormwater Permittees are adding imidacloprid to their Bay area monitoring programs in 2017.



http://cdpr.ca.gov/docs/emon/surfwtr/presentations/hha_swpp_exp_assmnt_2016.pdf

WASTEWATER TREATMENT PLANT MONITORING:

Several recent studies investigated the sources and fate of pesticides in wastewater influent and effluent. The Regional Monitoring Program funded a study that found fipronil and imidacloprid, two pesticides increasingly used in urban areas, in influent and effluent from all eight participating Bay Area wastewater treatment plants at levels above U.S. EPA's freshwater chronic benchmark to protect aquatic invertebrates. The study concludes that pet flea and tick products are likely the primary source of both pesticides to wastewater plant influent (*Sadaria 2016*).

DPR sampled laterals, influent, and effluent at laundromats, pest control operator businesses, and pet grooming operations in the Palo Alto sewershed. Results showed several pyrethroid pesticides, fipronil, and imidacloprid were detected in 100% of the samples, confirming that pet use products enter wastewater catchments, and indicating that other sources could include laundering pet bedding and human clothes, human showering, and cleaning indoor surfaces.

In addition, DPR studied dogs treated with fipronil-containing flea control products (*Teerlink 2017*). Results confirm a direct pathway of pesticides to municipal wastewater through the use of spot-on products on dogs and subsequent bathing by either professional groomers or by pet owners in the home. This study highlights the potential for other pesticides contained in pet shampoos and sprays to enter wastewater treatment plants.

SAN FRANCISCO BAY MONITORING:

The Regional Monitoring Program (RMP), a collaboration between the San Francisco Bay Water Board, the regulated discharger community, the San Francisco Estuary Institute, and many other interested parties, monitored Bay sediment for fipronil and legacy pesticides in 2014. Low concentrations of fipronil and its breakdown products were detected frequently, and the RMP identified fipronil as a contaminant of moderate concern to the Bay, meaning monitoring frequency may be increased. Also, the RMP funded the wastewater study described above in response to the concern about fipronil in the Bay. Pyrethroids, although a clear concern to urban creeks, are considered of low concern to the Bay to date.

The RMP has tested Bay water for toxicity and has observed no water toxicity over the past ten years (*SFEI 2015*).

Next Steps

Going forward, we will focus on the following actions in order to minimize and eliminate pesticide-related toxicity in San Francisco Bay Area water bodies:

- Continue to support the State Water Board as it drafts and proposes an amendment to the CA Inland Surface Waters & Enclosed Estuaries Plan to address pesticide-related toxicity in urban waters across the State.
- Increase our collaboration with DPR's current Surface Water Monitoring Program to improve the effectiveness of pesticide-related monitoring of urban waters.
- Encourage DPR to take appropriate actions to reduce future loading of imidacloprid and other neonicotinoids to California urban water bodies.

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