September 15, 2022

Contra Costa Clean Water Program Member Agencies

SUBJECT: Transmittal of the Contra Costa Clean Water Program Annual Report for Municipal Regional Stormwater National Pollutant Discharge Elimination System (NPDES) Permit (Order R2-2015-0049) as amended

Dear CCCWP Management Committee:

Enclosed please find the Contra Costa Clean Water Program's (CCCWP's) Fiscal Year (FY) 2021/22 Annual Report. This report documents permit compliance activities conducted during the previous fiscal year (July 1, 2021 to June 30, 2022) in accordance with National Pollutant Discharge Elimination System (NPDES) Permit No. CAS612008 (R2-2015-0049 [MRP 2.0]), as amended, issued by the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB).

The CCCWP prepared this Annual Report on behalf of the 21-member agency Permittees to document the collective activities of the Permittees and compile regional and statewide reports that support the Permittees compliance activities. The CCCWP FY 2021/22 Annual Report was approved by the Management Committee, in accordance with the CCCWP procedures, on September 12, 2022.

In 2021, the Regional Water Board notified CCCWP that their Municipal Annual Reports were to be submitted through the Stormwater Multiple Application and Report Tracking System (SMARTS) electronic submittal platform. Due to this change, Permittees are required to submit their Individual Permittee Annual Reports as well as the Program report directly through SMARTS. As such, the following must be uploaded into SMARTS and certified by each Permittee. For your convenience, the CCCWP FY 2021/22 Annual Report and the Regional/Statewide Supplemental Reports have been compiled into a single file.

1. **Your Individual Permittee Annual Report:** Contra Costa Permittees' individual Municipal Annual Reports document compliance activities conducted by each individual Permittee within their jurisdiction
2. **CCCWP FY 2021/22 Annual Report:** Compliance activities conducted collectively as a group by all 21 CCCWP Permittees
3. **Regional/Statewide Supplemental Reports:** These reports document compliance activities conducted regionally (Bay Area-wide) in coordination with the Bay Area Municipal Stormwater Collaborative (BAMSC) and statewide in coordination with the California Stormwater Quality Association (CASQA). In FY 2021-22, the following regional and statewide supplemental reports were prepared:
    a. *BAMSC Annual Reporting for FY 2021-2022, Regional Supplement for New Development and Redevelopment;*
    b. *CASQA Annual Reporting for FY 2021-2022, Our Water Our World Annual Summary Report; and,*

c. *CASQA, Pesticides Subcommittee Annual Report and Effectiveness Assessment 2021-2022.*

Sincerely,

Karin Graves

Acting Program Manager
Contra Costa Clean Water Program

Attachments: **CCCWP FY 2021/22 Annual Report and Regional/Statewide Supplements**

CONTRA COSTA CLEAN WATER PROGRAM

FISCAL YEAR 2021/22

ANNUAL REPORT

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List of Acronyms and Abbreviations

Acronym	Term
ACCWP	Alameda Countywide Clean Water Program
AGOL	ArcGIS Online
BAMSC	Bay Area Municipal Stormwater Collaborative
BASMAA	Bay Area Stormwater Management Agencies Association
BMPs	Best Management Practices
Caltrans	California Department of Transportation
CASQA	California Stormwater Quality Association
CCC	Contra Costa County
CCCWP	Contra Costa Clean Water Program
CCCFCWCD	Contra Costa County Flood Control and Water Conservation District
CCEAC	Contra Costa Engineering Advisory Committee
CCWF	Contra Costa Watershed Forum
CCWSWRP	Contra Costa Watersheds Stormwater Resource Plan
CGP	Construction General Permit
ConFire	Contra Costa Fire Protection District
COVID-19	Coronavirus Disease 2019
CTR	Click-through Rate
CVRWQCB	Central Valley Regional Water Quality Control Board
DWQ	Department of Water Quality
EBME	East Bay Municipal Engineers
E_P	Erosion Potential
FY	Fiscal Year
GBP	Green Business Program
GI	Green Infrastructure
GIS	Geographic Information System
GSI	Green Stormwater Infrastructure
HHW	Household Hazardous Waste
HM	Hydromodification Management
HMP	Hydrograph Modification Management Plan
IDDE	Illicit Discharge Detection and Elimination
IMP	Integrated Management Practices
IPM	Integrated Pest Management

Acronym	Term
JPA	Joint Powers Authority
LID	Low Impact Development
MOC	Municipal Operations Committee
MRP	Municipal Regional Permit
MS4	Municipal Separate Storm Sewer System
MTC	Metropolitan Transportation Commission
NPDES	National Pollutant Discharge Elimination System
OPP	Oil Payment Program
OVTA	On-land Visual Trash Assessment
OWOW	Our Water Our World
PAPA	Pesticide Applicators Professional Association
PCBs	Polychlorinated Biphenyls
PCOs	Pest Control Operators
PIP	Public Information and Participation
PMU	Priority Margin Units
POC	Pollutants of Concern
POTW	Publicly Owned Treatment Works
PSA	Public Service Announcement
RAA	Reasonable Assurance Analysis
RMP	Regional Monitoring Program
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board
SUA	Stormwater Utility Assessment
SWRP	Stormwater Resource Plan
TMDL	Total Maximum Daily Loads
UCMR	Urban Creeks Monitoring Report
USEPA	United States Environmental Protection Agency
WQ	Water Quality
WLA	Waste Load Allocation
WMAs	Watershed Management Areas

SECTION 1 – INTRODUCTION

Introduction

The Contra Costa Clean Water Program (CCCWP) comprises Contra Costa County (CCC), its 19 incorporated cities/towns[1], and the Contra Costa County Flood Control & Water Conservation District (District). These 21 public agencies are collectively referred to as "Contra Costa Permittees". The Contra Costa Permittees submit their CCCWP Fiscal Year (FY) 2021/22 Annual Report to the San Francisco Bay and Central Valley Regional Water Quality Control Board (SFBRWQCB) and (CVRWQCB) as required by the Municipal National Pollutant Discharge Elimination System (NPDES) Permit (see "Municipal Stormwater Permit" discussed further on Page 1-2). The Annual Report documents permit compliance activities conducted during the previous fiscal year (July 1, 2021, to June 30, 2022), and consists of the following:

- ❖ **Individual Municipal Annual Reports**: Contra Costa Permittees' individual Municipal Annual Reports document compliance activities conducted by each individual Permittee within their jurisdiction (submitted separately by each Contra Costa Permittee).
- ❖ **CCCWP FY 2021/22 Annual Report**: This report documents permit compliance activities conducted collectively as a group by all 21 Contra Costa Permittees.
- ❖ **BAMSC Regional/CASQA Statewide Supplemental Reports**: These reports document compliance activities conducted regionally (Bay Area-wide) in coordination with the Bay Area Municipal Stormwater Collaborative (BAMSC)[2] and statewide in coordination with the California Stormwater Quality Association

[1] Cities of Antioch, Brentwood, Clayton, Concord, El Cerrito, Hercules, Lafayette, Martinez, Oakley, Orinda, Pinole, Pittsburg, Pleasant Hill, Richmond, San Pablo, San Ramon, and Walnut Creek, and Towns of Danville and Moraga.

[2] In April 2021 the Bay Area Stormwater Municipal Agencies Association (BASMAA) dissolved. The coordination efforts of BASMAA have been replaced by Bay Area Municipal Stormwater Collaborative (BAMSC), which is a less formal organization without cost sharing abilities. Reports and committees created by BASMAA and retained under BAMSC will be referred to as BAMSC reports beginning with this FY 2021-2022 Annual Report. BAMSC will continue to serve as a consortium of municipal stormwater programs, representing over 90 agencies, including 79 cities and 6 counties, focused on regional challenges and opportunities to improving the quality of stormwater that flows to our local creeks, San Francisco Bay and delta, and the ocean.

(CASQA)[3]. In FY 2021-22, the following regional/statewide supplemental reports are to be included as submissions to the SFBRWQCB and CVRWQCB:

1. *BAMSC Annual Reporting for FY 2021-2022, Regional Supplement for New Development and Redevelopment;*
2. *CASQA Annual Reporting for FY 2021-2022, Our Water Our World Annual Summary Report; and,*
3. *CASQA, Pesticides Subcommittee Annual Report and Effectiveness Assessment 2021-2022.*

In July 2021, the Program and its participating Contra Costa Permittees were notified of changes to the Annual Reporting submittal process. Beginning FY 2020-2021 reporting year and for all subsequent years, Annual Reports are submitted via the SMARTS electronic submittal system. Given these changes, the Program is no longer able to submit the Annual Report on behalf of the Contra Costa Permittees. Instead, Contra Costa Permittees will submit the three elements of the Annual Report directly through their individual SMARTs accounts.

Municipal Stormwater Permit

The SFBRWQCB reissued its *Municipal Regional Stormwater NPDES Permit* to 76 Phase I[4] municipalities within the San Francisco Bay Region on November 19, 2015 (NPDES Permit No. CAS612008, Order No. R2-2015-0049) and this reissued permit, which took effect on January 1, 2016, is hereinafter referred to as "MRP 2.0." The previous permit (NPDES Permit No. CAS612008, Order No. R2-2009-0075), which was superseded by MRP 2.0 on January 1, 2016, is hereinafter referred to as "MRP 1.0". MRP 2.0 is in effect for five years ending on December 31, 2020. On December 20, 2020, MRP 2.0 was administratively extended by the SFBRWQCB until the new permit goes into effect.

[3] Formed in 1989, the California Stormwater Quality Task Force was a quasi-governmental organization, which advised the State Water Resources Control Board on matters related to developing stormwater regulations - more specifically, it was intended to help California comply with the municipal and industrial NPDES stormwater mandates of the federal Clean Water Act. The Task Force officially became the California Stormwater Quality Association (CASQA) in September 2002, when its formal 501 (c)(3) non-profit organization status was approved.

[4] Phase I regulations were promulgated in 1990 and require medium and large cities or certain counties with populations of 100,000 or more to obtain NPDES permit coverage for their stormwater discharges.

Throughout FY 2021-2022, the SFBRWQCB developed the new permit, referred to as "MRP 3.0". On May 22, 2022 the permit was adopted with the effective date of July 1, 2022. The first annual report to be submitted under MRP 3.0 will be following FY 2022-2023.

MRP 2.0 was amended on February 13, 2019, to add the cities of Antioch, Brentwood, and Oakley, and the eastern portions of unincorporated Contra Costa County and the Contra Costa County Flood Control & Water Conservation District (the East County Permittees), which are located within the jurisdiction of the Central Valley Regional Water Quality Control Board (CVRWQCB, Region 5) and were previously covered under a separate Joint Municipal NPDES Permit titled "East Contra Costa County Municipal NPDES Permit".

MRP 2.0 Permittees include all Phase I Municipal Stormwater Programs[5] in the San Francisco Bay Region, and the aforementioned East County Permittees. Each Permittee is individually responsible for complying with the permit mandates; however, MRP 2.0 allows and encourages Permittees to collaborate in the design, development, and/or implementation of certain mandates collectively (countywide, region-wide, and/or statewide). Activities conducted collectively are referred to as "group activities" and are documented in this Volume I report and in the regional and statewide supplemental reports noted on Page 1-2.

Unless specified otherwise, hereinafter all group activities reported below will reference activities conducted by all Contra Costa Permittees in accordance with MRP 2.0. A copy of the amended MRP 2.0 can be downloaded from a link found on the CCCWP website at: https://www.cccleanwater.org/about/permits.

[5] Phase I Municipal Stormwater Programs include: 17 public agencies comprising the Alameda Countywide Clean Water Program (ACCWP); 21 public agencies comprising the CCCWP; 15 public agencies comprising the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP); 22 public agencies comprising the San Mateo Countywide Water Pollution Prevention Program; the cities of Fairfield and Suisun City comprising the Fairfield-Suisun Urban Runoff Management Program; and, the City of Vallejo and the Vallejo Sanitation and Flood Control District.

CCCWP Overview

Program Agreement

The Contra Costa Permittees operate under a "Program Agreement", which was first entered into in 1991 and was last updated in 2010. The roles and responsibilities of CCCWP staff and the 21 Contra Costa Permittees are outlined within the Program Agreement (2010-2025).

Program Staffing

Staff to the CCCWP is provided by CCC. The CCCWP is staffed by five full-time staff positions and one 20-hour clerical position. For most of the year the two Watershed Management Planning Specialist (WMPS) positions were staffed by consultants, and in June 2022 the CCCWP was able to fill permanently fill one of the WMPS positions. The Program Manager has been on extended leave since August 2019. In FY 2021/22, all CCCWP resources and activities were managed by the Senior Watershed Management Planning Specialist as the Acting Program Manager. Additional technical and temporary staff support was provided, as needed, by consultants/contractors. See Attachment 1.1 for a listing of staff positions and the time certain positions were vacant, and consultants/contractors retained in FY 2021/22.

Organizational Structure

The Management Committee, which consists of one designated representative from each of the 21 Contra Costa Permittees, is the decision-making body of the CCCWP and provides direction to CCCWP staff and subcommittees. The Management Committee meets monthly and directs and monitors the implementation of all group activities. Six subcommittees and ad-hoc subcommittees: Administrative, Development, Monitoring, Municipal Operations, Public Information and Participation (PIP), and Select Committees review, research, and make recommendations to the Management Committee. CCCWP staff and designated municipal representatives participate on similar BAMSC subcommittees, which are focused on the implementation of tasks and projects conducted regionally. Attachment 1.2 outlines the CCCWP's organizational structure.

Attachment 1.3 shows Contra Costa Permittees' participation and attendance on the CCCWP's Management Committee and its subcommittees. In accordance with the Program Agreement, designated Permittee representatives are required to attend at least 80% of the CCCWP's regularly scheduled meetings.

Funding Stormwater Compliance Programs

Most Contra Costa Permittees' stormwater activities are funded by a stormwater utility assessment (SUA). The assessments were authorized in 1993 and range from $25 to $45 a year for a single-family home, depending on the municipality. Assessments for properties are based on estimates of stormwater runoff based on impervious area. The cities of Richmond and Brentwood do not have a SUA. In those two municipalities, stormwater pollution prevention activities are funded by other revenues, including the general fund. In addition, most Contra Costa Permittees that have the assessment for stormwater pollution prevention supplement those revenues from other sources.

Revenues from the SUAs are collected by the CCC Tax Collector with the property tax bill. The District is responsible for the administration and disbursement of the assessment revenues, which in FY 2021/22 totaled approximately $15,870,118. The assessment is restricted revenue that may only be used for NPDES program activities including construction of pollution control improvements and drainage system maintenance. Approximately 20% of these revenues are used to fund permit compliance activities that Contra Costa Permittees choose to conduct collectively (i.e., Group Activities). The remaining 80% of the revenue is "returned-to-source" (i.e., returned to the local jurisdiction from which it originated). The return-to-source revenue pays for permit compliance activities conducted at the municipal level. Each Permittee's cost share of Group Activities is apportioned by population. CCCWP staff, consultants, and contractors assisted Contra Costa Permittees in compliance with MRP 2.0 by providing technical support and guidance, staff training, and implementation of a variety of activities, including public education and outreach and water-quality monitoring. These activities are more effectively and cost-efficiently implemented as Group Activities. The CCCWP's FY 2021/22 budget was $4,220,421 and is available on the CCCWP's website at: https://www.cccleanwater.org/about/budget.

Within this budget, the CCCWP paid dues on behalf of the Contra Costa Permittees to: the San Francisco Bay Regional Monitoring Program (RMP), the Bay Friendly Landscape Coalition, the Green Business Program (GBP), and CASQA. These groups provide water quality monitoring and research activities that are mandated under the NPDES permits, and/or provide representation, guidance and/or staff training at the regional or state levels.

Contra Costa Permittees' authority to raise taxes or assessment fees to pay for governmental activities has been sharply constrained by voter initiatives such as Proposition 13[6] and Proposition 218[7]. Contra Costa Permittees' SUA rates have a maximum limit, which was established in 1993. All Contra Costa Permittees reached their maximum rate by FY 2009/10, when the SFBRWQCB adopted MRP 1.0. Since then, Contra Costa Permittees have been supplementing their SUA revenues with funding from other sources, including the general fund, to finance the ever-increasing stormwater compliance mandates.

Funding the unfunded federal and state mandated stormwater permit compliance programs continues to be the Contra Costa Permittees' most significant challenge. In the absence of new revenues for stormwater pollution prevention, Contra Costa Permittees have repeatedly advocated for the need to prioritize actions that have proven most beneficial to water quality and have asked that less beneficial permit requirements be eliminated or reduced. However, Contra Costa Permittees ultimately have no authority

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[6] Proposition 13 - In 1978 California voters passed Proposition 13, reducing property tax rates by about 57%. The basis for property tax calculation was rolled back to the 1976 assessed value. Reassessment of property value was allowed only upon change in property ownership and the assessment was limited to 1% of the sales price. Revenue for stormwater management agencies, such as a Flood Control Zone, was reduced significantly and the tax rate was locked in at the 1976 adopted rate. As time went on, stormwater management agencies could not raise revenue to keep up with needed construction, major maintenance, or replacement of failed drainage facilities.

[7] Proposition 218 - After Proposition 13 was passed, many stormwater management agencies turned to assessments and other measures to help fund services. In 1996, California voters passed Proposition 218, expanding the protection against property tax increases established by Proposition 13. Voter approval was now required for all new or increased assessments, charges or fees proposed by a stormwater management agency. Assessment proponents also had to demonstrate the specific benefit to properties before initiating or increasing the assessment. Fees and charges established or increased by agencies providing water or sewer services were expressly exempted from obtaining voter approval.

over permit conditions and cannot guarantee that permit conditions are reasonable or implementable, or that prescribed actions are effective or worthwhile. Contra Costa Permittees continue to explore ways to improve cost recovery and to assign costs for controlling certain pollutant sources that originate on private property. Contra Costa Permittees also continue to seek community partners for trash cleanup and other watershed stewardship activities and aim to align available stormwater grant funding with transportation funding and grant programs for integrated transportation and drainage infrastructure improvements.

Highlights of Group Program Activities for FY 2021/22

<u>Public Information and Participation</u>

Given the continued challenges brought by COVID-19, the CCCWP has continued to develop and improve its ability to conduct outreach, disseminate public information, and engage with the public through virtual or online means of connection. CCCWP continued to make improvements to the CCCWP website, maintain access to Program documents and participation through Groupsite for Contra Costa Permittee access, and has facilitated the exchange of information internally to Permittees and externally to the public. Webinars and virtual meetings continue to allow greater participation in CCCWP activities, as well as provide long-term platforms for engagement for and by the public.

In FY 21/22, CCCWP conducted an evaluation of brochures and pamphlets distributed to businesses and public entities within the County and are continuing to work to provide information that is accessible to citizens of the County.

In addition, the CCCWP has continued to collaborate the Illegal Dumping Think Tank, a multi-agency effort throughout Contra Costa County, to reduce illegal dumping. Together they created an outreach video which highlighted the severity of litter and dumping issues and proper disposal options. The video aired on Contra Costa County television and various social media platforms.

As a result, the CCCWP has finalized revisions to the 1-800-No-Dumping phone tree to make it easier to report to the right jurisdiction, and collaborated on meetings and outreach materials.

Water Quality Monitoring: Report Completion

In FY 2021/22, the CCCWP continued to make progress on the reporting and implementation of Provision C.8 Water Quality Monitoring. The *Urban Creeks Monitoring Report, Water Year 2021* (2021 UCMR) was submitted to the SFBRWQCB and CVRWQCB on March 31, 2022. This report is available at https://www.cccleanwater.org/monitoring/monitoringreports.

Implemented Control Measures to Achieve Mercury and PCB Load Reductions

MRP 2.0 Provisions C.11.a.iii.(2) and C.12.a.iii.(2) require reporting a list of the Watershed Management Areas (WMAs) where mercury and PCBs control measures are currently being implemented and those in which new control measures will be or have the potential to be implemented during the term of this permit, along with the specific control measures and an implementation schedule. Although many of the control measures may be selected primarily for the purpose of achieving PCBs load reductions during this permit term, substantial mercury load reductions may result as a tangential benefit and will be accounted for in tracking mercury load reductions. A *Mercury and PCBs Watershed/Management Areas*, *Control Measures, and Load Reduction – Update 2022* report (WMA report) was prepared by the CCCWP to fulfill the requirement of MRP Provision C.11.a.iii.(3) and C.12.a.iii.(3) for updating the list of control measures reported annually as necessary to account for new control measures. This WMA report is provided as Attachment 11.1.

Previous studies indicate that old industrial areas are the most likely land use type to contain high PCBs concentrations. CCCWP is continuing the source property identification process until all Old Industrial areas are screened and characterized for the likelihood of pollutant load removal and potential referral to the SFBRWQCB for further action. CCCWP has compiled the past decade of source property investigation data to develop a Conceptual Work Plan for Completing PCB Source Area Investigations. In FY

2021/22, CCCWP continued to use its GIS platform for data management and analysis determining actual and potential load reductions, and as a tracking and reporting tool for Provisions C.11 and C.12 implementation work. The CCCWP continues to evaluate and update the GIS platform to increase its utility and respond to the needs of Permittees.

Continued to Develop a Regional Alternative Compliance Program

The Cities of San Pablo, Walnut Creek, and Richmond, and Contra Costa County have partnered for a USEPA San Francisco Bay Water Quality Improvement Fund grant to develop and pilot a Regional Alternative Compliance System in Contra Costa County (the "Contra Costa County System"). The objective of the Contra Costa County System is to more efficiently and cost-effectively meet Municipal Regional Permit (MRP) and total maximum daily load (TMDL) water quality goals, while also providing a net environmental benefit. The development of the Contra Costa County System aims to create deliverables that can be implemented in other counties and agencies subject to similar water quality compliance requirements.

The Contra Costa Permittee leads have continued working with a Consultant Team to develop project deliverables. During FY 2021/22, work completed on the project included a revised draft System Summary Report, a legal review of the draft system, and presentations to multiple committees and participating agencies. More details on the work completed can be found in Section 3 – Provision C.3.

A Summary of Other Group Program Activities for FY 2021/22

In addition to the activities and programs highlighted above, Contra Costa Permittees collectively conducted a broad range of other activities and programs designed to reduce or eliminate the discharge of stormwater pollutants (i.e., anything other than stormwater) into and from municipal storm drain systems. This Volume I report documents the other activities conducted or coordinated collectively as follows:

Table 1-1: Group Program Activities

MRP 2.0 Provisions	Section
C.2 Municipal Operations – Controls to reduce non-stormwater discharges and polluted stormwater to storm drains and watercourses during operation, inspection, and routine repair and maintenance activities of municipal facilities and infrastructure.	2
C.3 New Development and Redevelopment – Source controls, site design, and stormwater treatment measures in new development and redevelopment projects to address both soluble and insoluble stormwater runoff pollutant discharges, and controls to prevent increases in runoff flows from new development and redevelopment projects.	3
C.4 Industrial and Commercial Site Controls – Inspections and enforcement of stormwater pollution prevention measures at businesses to prevent pollutant exposure and discharges into and from municipal storm drain systems.	4
C.5 Illicit Discharge Detection and Elimination (IDDE) – Surveillance, spill and complaint investigations, control of mobile sources, and enforcement and case follow-up.	5
C.6 Construction Site Controls – Inspections and enforcement of construction site stormwater pollution prevention to reduce and eliminate pollutant discharges into and from municipal storm drain systems.	6
C.7 Public Information and Outreach – Information and outreach to increase knowledge and encourage behavior changes of target audiences regarding the impacts of stormwater pollution on receiving water and of pollution prevention solutions to mitigate the problems, respectively.	7
C.8. Water Quality Monitoring – Water quality monitoring activities including: 1) San Francisco Estuary receiving water monitoring; 2) creek status monitoring; 3) stressor source identification investigation; 4) Pollutants of Concern (POC) monitoring; 5) pesticides and toxicity monitoring; and 6) reports submitted annually on March 31.	8

MRP 2.0 Provisions	**Section**
C.9 Pesticide Toxicity Control – Actions to prevent impairment of urban streams by pesticide-related toxicity including implementation of Integrated Pest Management (IPM); outreach and training to municipal employees, pest control operators (PCOs), and residents; and, outreach to consumers on less-toxic methods of pest prevention and control.	9
C.10 Trash Load Reduction – Implementation of control measures and other actions to reduce trash loads discharged into municipal storm drainage systems and receiving water bodies.	10
C.11 Mercury Controls – Implementation of control measures to reduce total mercury and methylmercury loads in accordance with load reduction allocations established for urban runoff in the San Francisco Bay Mercury and the Sacramento San Joaquin Delta Methylmercury TMDLs.	11
C.12 Polychlorinated Biphenyls Controls – Implementation of control measures to reduce PCBs loads in accordance with load reduction allocations established for urban runoff in the San Francisco Bay PCBs TMDL.	12
C.13 Copper Controls – Implementation of source control Best Management Practices (BMPs)[8] to reduce and eliminate discharges containing copper into and from municipal storm drainage systems.	13
C.15 Exempted and Conditionally Exempted Discharges – Implementation of control measures to eliminate any adverse impacts to receiving waters from exempted unpolluted non-stormwater discharges, such as flows from natural springs; and, conditionally exempted non-stormwater discharges that are potential sources of pollutants, such as swimming pools and spas and irrigation water.	14
C.16.5 Provisions Applicable to East County Permittees – This Provision was added to the MRP in January 2019 to include the Cities of	15

[8] A BMP is defined as any program, technology, process, siting criteria, operating method, measure, or device which controls, prevents, removes, or reduces pollution.

MRP 2.0 Provisions	Section
Brentwood, Antioch and Oakley, and portions of Unincorporated County and the Flood Control District located in Water Quality Control Board Region 5 (East County Permittees), as dischargers named in the San Francisco Bay MRP. The provisions align the activities of East County Permittees with Permittees located in Region 2 and describe actions by East County Permittees necessary to implement TMDLs applicable in Region 5.	

COVID-19 Impacts

This annual report provides the Regional Water Board with an update on the specifics of the requirements and provisions of the San Francisco Bay Region Municipal Regional Stormwater NPDES Permit (MRP), Order R2-2015-0049, that were impacted by Contra Costa County Health Orders for COVID-19. An overview of the impacts experienced by the Contra Costa Permittees is discussed in this section. In addition, the response efforts relating to MRP provisions were conducted by Permittees differently, in accordance with their jurisdiction's relevant circumstances, and Permittee-specific considerations have been included in their individual reports.

It has been and still is deemed essential that the health and safety of all Contra Costa Permittee staff and contractors be protected to the maximum extent reasonably possible. All activities performed must be in accordance with State and local orders and guidelines. As the COVID-19 pandemic has evolved and operations have returned to a near normal status, there continue to be some remaining impacts on Contra Costa Permittee abilities to comply with some permit requirements.

- **Operational Delay.** Many Permittees were required to work remotely or in a hybrid-mode at the beginning of FY 2021/2022. While most in-office work has resumed, illness from periods of Covid outbreaks resulted in a large number of employees taking time off to recover, causing some operational delays.

- **Staff Reassignments.** Permittees have a role in emergency response efforts, and the pandemic posed a societal emergency requiring many Permittees to open their emergency operations centers. This resulted in reassignment of staff resources to meet the staffing needs of their emergency operations. Although this was a rather short-term effort for most Permittees, except perhaps for the County, it continued to disrupt operations especially in the beginning of FY 2021/2022.
- **Budget Reductions.** A primary source of general-purpose revenue for most Permittees is from sales tax. At the onset of the pandemic only essential business operations were open, reducing local sales tax revenue dramatically. Subsequent relaxation of certain restrictions has allowed most businesses to open at full capacity. This has increased some sales tax but the overall loss of revenue continued to result in budget reductions in Permittee stormwater divisions and in departments and divisions that support stormwater operations.

Despite these impediments, Contra Costa Permittee staff and their contractors and consultants continue to make all reasonable efforts to perform required permit activities while at the same time taking the necessary precautions to minimize exposure to themselves and the general public.

SECTION 2 – PROVISION C.2 MUNICIPAL OPERATIONS

Introduction

CCCWP staff, consultants and municipal staff participate on the Municipal Operations Committee (MOC), which assists in the review and preparation of guidance and training for municipal staff with respect to Provisions C.2 (Municipal Operations), C.4 (Industrial Commercial Site Controls), C.5 (Illicit Discharge Detection and Elimination), C.9 (Pesticide Toxicity Control), C.10 (Trash Load Reduction), C.13 (Copper Controls), and C.15 (Exempted and Conditionally Exempted Discharges) of the MRP. CCCWP staff also participate in the BAMSC MOC, which coordinates related regional activities. This section of the Annual Report will focus on municipal operation activities (Provision C.2). Reporting related to Provisions C.4, C.5, C.9, C.10, C.13, and C.15, are covered in Sections 4, 5, 9, 10, 13 and 14, respectively, in this Volume I Report.

In FY 2021/22, Joseph Camaddo (City of Pittsburg) and Michelle Giolli (Contra Costa Flood Control District) served as Chair and Vice Chair, respectively, of the CCCWP MOC. The regular MOC typically meets the third Tuesday of each month. In FY 2021/22, the regular MOC met in all months except December 2021 and March 2022.

Amanda Booth (City of San Pablo), Beth Baldwin (Unincorporated Contra Costa County), and Elizabeth Yin (CCCWP augmented staff) represented the CCCWP at the BAMSC MRP 3.0 C.10 Trash Subcommittee. Work undertaken by this committee is discussed in Section C.10.

A listing of Contra Costa municipal representatives on the CCCWP MOC is included in Attachment 1.4. Summary minutes of these meetings are available in the FY 2021/22 Management Committee agenda packets provided on the CCCWP website at http://www.cccleanwater.org/meetings/.

FY 2021/22 Accomplishments

The monthly MOC meetings provide an opportunity to further train and educate Contra Costa Permittees on subjects that are relevant to municipal operations and permit compliance. The meetings also serve as a forum to discuss municipal operations such as pest management, trash controls, or illicit discharge response. There are also opportunities to hear from guest speakers, share audit findings of stormwater programs relative to municipal operations, or identify the need for new or updated public outreach material based on findings from stormwater inspections. Below are some of the highlights from MOC activities for FY 2021/22.

Presentations by Guest Speakers

As part of an ongoing effort to build relationships with agencies whose work may potentially intertwine with MOC's activities, guest speakers are invited to give presentations on their respective programs to this committee or to Management Committee when applicable. In FY 2021/22, presentations were given by the following persons:

- Presentation on CALTRANS Partnership opportunities by Anand Maganti (CALTRANs).
- Presentation on AGOL Trash Reporting Tool by Joe Camaddo (City of Pittsburg).
- Presentation on AGOL Planned Updates by Lisa Welsh (CCCWP augmented staff).
- Presentation on Private Land Drainage Area inspections by Michelle Giolli and Beth Baldwin (Contra Costa County).
- Presentation on MRP 3.0 Trash Requirements by Elizabeth Yin (CCCWP augmented staff).
- Beth Slate presented on Contra Costa County Department of Agriculture activities.

Additionally, specialized workshops provided training for CCCWP staff, including:

- Stormwater Inspector Training Workshop (C.4, see description below) – June 22, 2022

Finally, announcements were regularly sent out to the MOC to notify Contra Costa Permittees of upcoming region-wide workshops and activities of interest to Permittees.

FY 2022/23 Planned Activities

In FY 2022/23, the CCCWP MOC will continue to review and provide assistance to municipal maintenance and operations staff, where necessary, to ensure consistent and effective BMPs are implemented during the operation, inspection, and routine repair and maintenance activities of municipal facilities and infrastructure. This includes, but is not limited to: graffiti removal, implementation of Corporation Yard Stormwater Pollution Prevention Plans, municipal stormwater pump station inspection, operation, maintenance, and monitoring, implementation of appropriate BMPs during road, parking lot and bridge repair and maintenance work; and, complying with the reporting requirements in Provision C.2 and other relevant provisions to municipal operations.

In particular, the MOC will review MRP 3.0 for those provisions under the purview of the municipal operations and will recommend improvements on reporting and implementation of those permit elements.

SECTION 3 – PROVISION C.3 NEW DEVELOPMENT AND REDEVELOPMENT

Executive Summary of FY 2021/22 C.3 Activities

Throughout FY 2021/22, CCCWP staff and consultants, and the staff of Contra Costa Permittees, were engaged in the negotiation of Provision C.3 requirements in MRP 3.0, which was adopted in May 2022. CCCWP staff and consultants identified urgent tasks for Permittee compliance and began assisting Permittees to implement those tasks. CCCWP's Development Committee, with the assistance of CCCWP staff and consultants, drafted and reviewed updates to the *Stormwater C.3 Guidebook,* including MRP 3.0 changes and a new chapter to support the identification and preliminary design of Green Infrastructure projects. The Development Committee planned completion of the *Guidebook* 8th Edition for fall 2022. CCCWP organized and presented a Low Impact Development (LID) online seminar attended by about 145 land development and professional staff.

FY 2021/22 Objectives

The Development Committee's FY 2021/22 work was guided by the following objectives:

- Facilitate Permittee compliance with MRP Provision C.3.
- Facilitate planning, design, construction, and maintenance of permanent controls on new developments in Contra Costa Permittees' jurisdictions.
- Facilitate Contra Costa Permittees' planning, design, construction, and maintenance of Green Infrastructure facilities in Permittees' jurisdictions.
- Organize and implement all required C.3 group activities and submittals.
- Negotiate permit requirements and interpretations that protect water quality and are implementable and cost-effective.
- Continuously improve Program outreach, guidance, and training on C.3 requirements.
- Continue CCCWP's regional and statewide role as an exemplar and leader in implementation of new development controls.

FY 2021/22 Accomplishments – Overview

During FY 2021/22 the Development Committee was chaired by Joe Camaddo (City of Pittsburgh). John Steere (Contra Cost County) served as vice-chair. Staff from Antioch, Brentwood, Clayton, Concord, Contra Costa County, Danville, Hercules, Lafayette, Moraga, Oakley, Pittsburg, Pleasant Hill, San Ramon, and Walnut Creek were voting members of the Committee. The Development Committee met monthly throughout the fiscal year, except for November. The November and December meetings were combined to accommodate end-of-the-year holidays.

In addition to supporting implementation of Permit requirements, CCCWP staff and consultants—and Permittee staff—participated in the Bay Area Municipal Stormwater Collaborative (BAMSC, formerly BASMAA) MRP 3.0 C.3/Green Infrastructure (GI) Work Group. The Work Group also met throughout the fiscal year. CCCWP 2021/22 contributions to this Work Group—which built on contributions made throughout the previous fiscal year—included the following:

- CCCWP's consultant developed a table comparing Provision C.3.b.ii requirements (thresholds for Regulated Projects) in MRP 3.0 vs. MRP 2.0.
- CCCWP's consultant collaborated with countywide stormwater program staff and permittees regionally to review and prepare comments for the MRP 3.0 TO and Revised TO.

CCCWP staff and consultants, and Contra Costa Permittee staff, also attended meetings of BAMSC's New Development Subcommittee (formerly BASMAA's Development Committee). Contra Costa's contributions to this subcommittee included the following:

- CCCWP presented at the subcommittee May 3, 2022, meeting on the changes impacting implementation of C.3.b.ii requirements (such a thresholds for regulated projects) in the MRP 3.0 Revised TO as compared to MRP 2.0.

- Contra Costa County staff are developing a plant guide for bioretention facilities where irrigation is not feasible (for space/ plumbing concerns). When complete, the guide will be shared with CCCWP Permittees and BAMSC members.

FY 2021/22 Accomplishments – Regulated Projects (Provisions C.3.a. – C.3.i.)

C.3.g - Hydromodification Management (HM)

Background and Previous Years' Activities

A 2003 permit amendment required CCCWP to prepare a Hydrograph Modification Management Plan (HMP). Similar requirements were added to the Santa Clara permit in 2001. Contra Costa's HMP was developed in 2003-2005 and emphasizes the use of LID to mitigate changes in runoff caused by land development. The SFBRWQCB approved the HMP in mid-2006. The HMP included requirements for monitoring of some bioretention facilities and for calibration and verification of the model used to calculate the bioretention sizing factors. The 3rd Edition of the *Stormwater C.3 Guidebook* (October 2006) incorporated HM requirements, including the sizing factors, into criteria for LID design on projects subject to the HM requirements.

Designs for bioretention facilities were further developed and refined in 2006-2008. The *Guidebook* 4th Edition (2009) included variations on bioretention designed and incorporated sizing factors for all facilities based on limiting flow exiting via facility underdrains to two-tenths of 2-year event (0.2Q2). MRP 1.0 (2009) imposed 0.1Q2, but allowed Contra Costa to continue to use 0.2Q2 for the permit term. MRP 1.0 also renewed the requirement for a model calibration and verification study.

The study proceeded in FY 2011/12 and FY 2012/13. Tony Dubin of Dubin Environmental Consulting conducted the model calibration and verification. CCC Flood Control District staff conducted the monitoring. A report was completed and submitted with the 2013 Annual Report. Monitoring data showed that exfiltration from the bioretention facilities was 0.24 inches per hour, an order of magnitude higher than the rate assumed in the original model. Largely because of this difference, using the calibrated model, sizing factors would not need to increase even if the 0.1Q2 flow limit were to be met.

For MRP 2.0, CCCWP sought to also change criteria in Provision C.3.g. that favor the use of flow duration control basins rather than LID. This effort started with developing potential alternatives to the curve-matching criteria in Provision C.3.g.ii.(2). In early 2015, following discussions with SFBRWQCB staff, BASMAA retained Judd Goodman, then of Geosyntec Consultants, to develop a memorandum describing how the potential for downstream stream bed and bank erosion (erosion potential, or E_P) could be estimated directly, rather than relying on the matching of flow-duration curves. Mr. Goodman collaborated with Mr. Dubin. The modeling results from the 2013 CCCWP report were used as input for Goodman's calculations of E_P.

Additionally, in MRP 2.0, the Water Board required Contra Costa permittees to submit a technical report, due with the 2017 Annual Report, describing how CCCWP's criteria will be updated. The update was to be implemented by January 3, 2018. At a July 20, 2017, meeting, CCCWP consultants demonstrated how three "sensitive" parameters—lower threshold for sediment movement, facility exfiltration rate to native soils, and projected future increases in watershed imperviousness—interact to affect minimum sizing factors. It was shown how a selected value for sizing factor could be fully protective for a broad variety of reasonable combinations of the project's critical flow rate, facility exfiltration rate, and assumed future increase in watershed imperviousness. It was proposed to use this approach rather than using the "most conservative" values for all three sensitive parameters.

It was further proposed that this report would recommend an appropriate sizing factor for the "base case" of a bioretention facility in Hydrologic Soil Group "D" soils, which represents most future development in Contra Costa. Representative values for the three sensitive parameters that correspond to this selected sizing factor would then be used to generate the remaining sizing factors (for other facility types and other soil groups).

The Technical Report was submitted as required on September 30, 2017. CCCWP staff e-mailed SFBRWQCB staff on September 7, 2017, reviewing these proposed steps, stating that CCCWP anticipated being able to prepare updated sizing factors by January 3, 2018, if CCCWP received notice of the SFBRWQCB's acceptance of the technical report by October 31, 2017 and also stating CCCWP's understanding that Contra Costa Permittees would not be penalized for continuing to use the current sizing factors until any issues are resolved. SFBRWQCB staff responded the following day that "this sounds acceptable," and CCCWP staff followed up with an e-mail on November 15, 2017 noting that comments had not been received, that Contra Costa Permittees would be guided to continue implementing HM criteria in the Stormwater C.3 Guidebook beyond that January 3, 2018 date, and suggesting a meeting once SFBRWQCB staff had reviewed and commented on the Technical Report.

CCCWP staff emailed SFBRWQCB staff on September 24, 2019, to request a response. Another email was sent on February 6, 2020. SFBRWQCB staff responded on March 1, 2020, and a meeting was held (via remote conferencing) on April 14, 2020. For this meeting, CCCWP compiled and summarized documentation of discussions held, and consensus reached, as the Technical Report was being prepared in 2016 and 2017. CCCWP also researched and provided language from other California Water Boards that supports the direct-simulation-of-erosion-potential approach used in the 2017 report. At the April 14, 2020, meeting, SFBRWQCB staff committed to providing written comments on the September 30, 2017, submittal.

CCCWP staff followed up the April 14, 2020, meeting with a May 5, 2020, email, requesting a timeline for the written comments.

On July 10, 2020, SFBRWQCB sent a communication, "Memo to CCCWP Regarding Their Hydromodification Technical Report and Hydromodification Applicability Map, Submitted September 29, 2017." CCCWP sent an initial response on July 13. Preparation of a response to all questions was delayed due to COVID response and due to resources diverted to ongoing permit negotiations. A response was sent on November 4, along with a request to meet to discuss questions SFBRWQCB staff had regarding CCCWP's approach.

CCCWP staff followed up December 8 to reiterate the request for a meeting to discuss the July 10 SFBRWQCB comments and the November 4 CCCWP response. SFBRWQCB staff responded the same day, saying they would follow up shortly.

SFBRWQCB sent a March 19, 2021, memo “intended to advance discussions…” After acknowledging the memo the same day, CCCWP worked to restart technical consultant services that had been inactive since the Technical Report submittal in 2017. On April 19, 2021, CCCWP staff wrote SFBRWQCB staff to propose meeting dates. A meeting with SFBRWQCB staff, CWP staff and consultant was held on May 13, 2021, including the technical consultants Tony Dubin and Judd Goodman, focused primarily on clarifying the SFBRWQCB’s July 10, 2020, comments and the November 4, 2020, CCCWP responses.

A follow-up meeting with SFBRWQCB staff, CCCWP staff and consultants was held on June 2, 2021, to identify ways to move forward with the reissuance of the MRP 3.0 Tentative Order now imminent. The outlines of permit language were discussed. CCCWP staff provided a working markup of Provision C.3.g., along with a summary and explanation, on June 9. The materials were reviewed in a meeting that day that included Zach Rokeach (SFBRWQCB staff) and Dan Cloak, Tony Dubin, and Judd Goodman (CCCWP consultants).

FY 2021/22 Accomplishments

The MRP 3.0 Tentative Order (TO) was released on September 10, 2021. TO Provision C.3.g.v.(2) directs Contra Costa Permittees to use the criteria in the current *Guidebook,* as it may be updated, until the SFBRWQCB Executive Officer approves an additional Technical Report, to be submitted with the 2023 Annual Report, and thereafter use methods and criteria in the Executive Officer’s approval or conditional approval of that report. The TO also asked that new sizing factors be calculated with a “base case” sizing factor of 6.5% rather than the 5% proposed in the 2017 Technical Report.

CCCWP staff and consultants reviewed the C.3.g language included in the TO and submitted comments in the CCCWP November 15, 2021, comment letter. SFBRWQCB staff considered the CCCWP comments, but did not significantly change the C.3.g language in subsequent versions of the permit. Subsequently, the CCCWP discussed and added an item to its FY 2022/23 budget for an ‘HM Options Report.’ The Report will evaluate CCCWP permittee options for compliance with MRP 3.0 C.3.g requirements.

FY 2022/23 Planned Activities

Complete the HM Options Report noted above and decide on a C.3.g compliance option for CCCWP permittees. Estimated costs and timeline for the options will vary and will be informed by the report.

<u>HM Applicability Maps</u>

Background and Previous Years' Activities

MRP 2.0 required Contra Costa Permittees to prepare HM applicability maps by September 2017. The maps are to show locations where projects may be exempted because they are in a catchment that drains to pipes or a hardened channel that extend continuously to the Bay, Delta, or a flow-controlled reservoir, or drain to channels that are tidally influenced, or are located in a catchment or subwatershed that is 70% or more impervious. CCCWP's Geographic Information System (GIS) Consultant, PSOMAS used a digital elevation model to delineate sub-basins (catchments). The sub-basins were overlaid on a national land cover dataset to determine sub-basins with imperviousness equal to or greater than 70%. Channel hardening was determined using ortho-imagery, and the initial determination was reviewed and corrected by Permittee staff. Sub-basins draining to hardened channels all the way to the Bay/Delta were manually coded as exempt. The maps were submitted, along with PSOMAS' Technical Report, on September 30, 2017, as required.

Because MRP 2.0 Provision C.3.g.vi. requires that the new HM Applicability Maps be "acceptable to the Executive Officer," and no response to the submittal was received, Contra Costa Permittees have been guided to implement existing policies (consistent with Attachment C in MRP 1.0) in the interim. The April 14, 2020, meeting with SFBRWQCB staff included discussion of the maps, and some of the comments in the July 10, 2020, memo from SFBRWQCB staff addressing the maps.

There was brief discussion of the 2017 draft HM Applicability Map—and of SFBRWQCB staff's July 10, 2020, comments on the Map—at the June 2, 2021, meeting regarding the 2017 Technical Report. CCCWP staff and consultants contacted Contra Costa County and Contra Costa County Flood Control and Water Conservation District staff to request that they update their input into the draft maps in response to SFBRWQCB staff's comments.

FY 2021/22 Accomplishments and FY 2022/23 Planned Activities

In FY 2021/22 CCCWP staff and consultants intended to work with PSOMAS to revise the maps with input from Permittees, including Walnut Creek, Brentwood, Contra Costa County, and the Contra Costa County Flood Control and Water Conservation District. The project was postponed until FY 2022/23 to capture any potential new requirements from MRP 3.0.

<u>CCCFCWCD Policy on C.3 Facilities and Flood Control</u>

Background and Previous Years' Activities

Designs for proposed land developments within Contra Costa County must include facilities to safely collect and convey runoff from the development site. Depending on the site's characteristics and location, flood storage may be required to match peak runoff to pre-development conditions, and/or to limit effects on downstream facilities. The Contra Costa County Flood Control and Water Conservation District (CCCFCWCD) reviews proposed designs on behalf of municipal planning authorities.

An April 2019 CCCFCWCD memo concludes that C.3 facilities should not be relied on to mitigate peak flows. A February 2020 draft update to that memo suggested potential alterations to C.3 facilities that could allow them to be considered to have some mitigating effect.

Local stormwater coordinators are concerned that these design alterations, and proposals to combine flood control and stormwater treatment in a single facility, could result in facilities that have compromised performance, are difficult or impossible to maintain, and which lack the LID aesthetic qualities and ancillary benefits needed for long-term resiliency.

Design of flood control facilities and design of C.3/LID facilities use different hydrologic analysis methodologies and have different objectives for controlling flows.

During FY 2020/21, CCCWP's Development Committee formed a Work Group, comprising CCCFCWCD staff and representatives of Walnut Creek, Concord, Martinez, and other CCCWP permittees. The Work Group convened in October 2020 and held five additional 1-hour meetings during the following months.

This effort led to consensus that, if C.3/LID features and facilities are to be credited for peak-flow mitigation, it will be necessary to specify both the design criteria and the methods of hydrologic analysis applicants' engineers will be required to use.

The Work Group considered three possible outcomes:

1. No credit for C.3/LID features or facilities would be allowed when determining measures needed for peak-flow mitigation (this is similar to existing policy).

2. Adopt criteria and methods for explicit analysis of the peak-flow-mitigation benefit of C.3/LID measures.

3. Apply a conservative "rule of thumb"-based credit toward peak-flow mitigation benefit.

The Development Committee reviewed the Work Group's report and recommended that CCCWP further investigate ways to adopt criteria and methods for explicit analysis of peak-flow-mitigation benefits of C.3/LID. Pending consensus from municipalities that they would consider implementing criteria and methods developed by CCCWP for this purpose, the Development Committee recommended, and the Management Committee agreed, to budget, in FY 2021/22, for additional hydrologic analysis needed and to consider incorporating peak-flow analysis into the *Stormwater C.3 Guidebook* and the IMP Sizing Calculator.

FY 2022/23 Planned Activities

CCCWP staff and consultants plan to resume work on this project in FY 2022/23. The project's goal is to integrate flood control criteria into CCCWP's IMP Sizing Calculator. This task entails additional hydrologic analysis and related work updating the calculator as well as developing criteria for integrated facilities to be incorporated into the next editions of the *Stormwater C.3 Guidebook*.

Other Program Activities Related to Changes in MRP 3.0 Regulated Projects Requirements: Regulated Projects (Parcel-Based)

Background and FY 2021/22 Activities

Throughout FY 2021/22, CCCWP staff and consultants, and the staff of Contra Costa Permittees, were engaged in the negotiation of Provision C.3 requirements in MRP 3.0, adopted May 2022. Among other tasks, CCCWP staff and consultants tracked changes to definitions and thresholds for "Regulated Projects," which are those projects requiring stormwater LID treatment. The MRP 3.0 changes to Regulated Projects thresholds changes apply to projects approved beginning July 1, 2023.

In summary, for parcel-based (non-roadway) projects under MRP 3.0:

1. Construction of one detached single-family home that creates or replaces 10,000 SF or more of impervious surface is a Regulated Project.

2. All other projects, regardless of land use, which create or replace 5,000 SF or more of impervious surface are Regulated Projects.

3. It has been clarified that renovation of parking lots and other paved areas where the base course is affected must be counted toward the 5,000 SF Regulated Project threshold.

To address these changes, CCCWP consultants are updating the *Stormwater C.3 Guidebook*. CCCWP staff and consultants have been drafting several updates to the *Guidebook*, presenting them at the Development Committee meetings, and soliciting input from Permittees.

FY 2022/23 Planned Activities

As noted, several updates to the *Guidebook* are in progress and anticipated to complete in the early part of FY 2022/23. A revised 8th Edition is anticipated in Fall 2022. CCCWP will also produce a "C.3 Update," a countywide outreach document that will include an overview of MRP 3.0 changes for Regulated Projects. Permittees' staff will distribute this documentation to the land development community.

<u>Other Program Activities Related to Changes in MRP 3.0 Regulated Projects Requirements: Road Construction and Maintenance Projects</u>

Background and FY 2021/22 Accomplishments

As noted, CCCWP staff and consultants were engaged in the negotiation of Provision C.3 requirements in MRP 3.0, adopted May 2022. Among other tasks, CCCWP staff and consultants tracked changes to stormwater LID treatment for road construction and maintenance projects. In summary, new requirements for road construction and maintenance (applicable July 1, 2023) are:

- New roads and trails, or widening with additional travel lanes, which create 5,000 contiguous SF or more of impervious surface are now Regulated Projects.
- One contiguous acre or more of pavement maintenance that affects the base course, or extends the roadway, is now a Regulated Project.
- Utility trenching projects that extend over a contiguous acre or more are now Regulated Projects.

To address these changes, CCCWP consultants drafted updates to Chapter 1 of the *Stormwater C.3 Guidebook*.

FY 2022/23 Planned Activities

CCCWP will produce a memo for Permittees CIP planning and public works staff informing them of the changes to LID requirements for road construction and maintenance projects. Throughout the permit term, Permittees will need to review capital projects and road maintenance and determine if any might be Regulated Projects. CCCWP staff and consultants will be available to consult with Permittees throughout this process, as needed.

Other Updates to the Stormwater C.3 Guidebook

Background and Previous Years' Activities

CCCWP published the first edition of the *Stormwater C.3 Guidebook* in 2005. The current 7th Edition was published during 2016-2017. Ancillary documents, including example projects and updated templates, were posted to the CCCWP website in 2018.

FY 2021/22 Accomplishments

CCCWP staff and consultants have been drafting several updates to the *Guidebook*, presenting them at the Development Committee meetings, and soliciting input from Permittees. Remaining edits are related to implementation of new requirements in MRP 3.0, including CCCWP's to-be-determined strategy for compliance with HM requirements, expanded guidance on Green Infrastructure, updates to references, and improved document organization.

FY 2022/23 Planned Activities

CCCWP anticipates completing the *Stormwater C.3 Guidebook 8th Edition* in Winter 2022.

Outreach and Training

Background and Previous Years' Activities

Since 2004, CCCWP has sponsored a workshop on LID planning, design, and construction nearly every year. Workshops typically include an overview of C.3 requirements, implementation procedures, and design guidance in accordance with the *Stormwater C.3 Guidebook.* Participants include private-sector land development professionals and municipal staff.

Also, since 2004, CCCWP has maintained pages at www.cccleanwater.org with links to resources for implementing Provision C.3 requirements. These resources include the *Stormwater C.3 Guidebook,* CCCWP's Integrated Management Practices (IMP) Sizing Calculator, templates for Stormwater Control Plans, Stormwater Control Plan examples, miscellaneous memoranda, submittals to the Water Boards, and slides and materials used in trainings.

FY 2021/22 Accomplishments

CCCWP sponsored a Provision C.3 Compliance Workshop, “Planning, Design, Construction, and Maintenance of Low Impact Development Features and Facilities,” held on May 24, 2022. This was initially scheduled as an in-person workshop to be held in Walnut Creek, but was switched to a webinar due to on-going public health concerns. There were 159 registrants and about 140-145 participated in the online seminar. Slightly more than half the attendees are engineers or engineering technicians working for consulting firms or land development companies that prepare LID designs for development. Somewhat less than half were engineers, planners, architects, and inspectors working for stormwater NPDES permittees. About 45% of participants had previously attended a CCCWP C.3 workshop.

Presentations included a review of the basics of Provision C.3 compliance and Low Impact Development design, an update on changes to Provision C.3 in MRP 3.0, and a brief training on Green Infrastructure project identification and preliminary design techniques. As with previous years’ workshops, the presentations were followed by a panel made up of experienced municipal stormwater staff: Mitra Abkenari (City of Concord), Phil Hoffmeister (City of Antioch), Frank Kennedy (Kennedy and Associates), and Ryan Cook (Walnut Creek). The panelists led an interactive discussion of five key topics in LID implementation.

Upon exiting the Zoom webinar, participants were asked to answer four questions to provide feedback. 25 responses were received. The responses were entirely positive.

The workshop agenda and slides have been posted to the CCCWP website. The webinar was recorded, and a link to the recording is also on the CCCWP website for C.3 Workshops and Conferences:
https://www.cccleanwater.org/development-infrastructure/development/c-3-workshops-conferences.

FY 2022/23 Planned Activities

In FY 2022/23, the CCCWP plans to hold a similar half-day LID workshop (ideally in person) on C.3 topics relevant for municipal staff and land development professionals.

<u>Development of Countywide GIS and Database Capabilities</u>

Background and Previous Years' Activities

CCCWP has collaborated with the Alameda Countywide Clean Water Program (ACCWP) since FY 2015/16 to develop GIS capabilities (ArcGIS Online, or AGOL) for facilitating planning, tracking, and reporting of NPDES compliance activities, including activities to reduce discharges of trash and pollutants of concern. During FY 2016/17, CCCWP and ACCWP initiated efforts to incorporate into AGOL features that would allow integrated tracking and reporting of Regulated Projects in accordance with Provisions C.3.b. (Project approvals), and C.3.e. (Special Projects).

During that year and into FY 2017/18, a "C.3 module" was created within AGOL to facilitate tracking and reporting of Regulated Projects and Green Infrastructure street and drainage retrofit projects. The primary purpose of the module and the Contra Costa Permittees' data entry into the module was to track and document load reductions achieved as a result of C.3 implementation. The Contra Costa Permittees continued to use their own, separate, tracking systems for C.3.b., and C.3.e., reporting requirements.

FY 2021/22 Accomplishments

In FY 2021/22 CCCWP staff, consultants, and permittees staff reconvened the ad-hoc Workgroup to address updates to the ArcGIS Online (AGOL) platform. Permittees currently rely on AGOL to track Hg/PCBs load reductions through GI projects and Source Property referrals to help demonstrate compliance with Provision C.3 and Provisions C.11/C.12. Permittees also use AGOL to track trash load reduction and demonstrate compliance with Provision C.10.

The system has been used for developing maps for the Stormwater Resources Control Plans, Hydromodification and Private Lands Drainage Area, all of which required submittals in MRP 2.0. There are currently 5 ArcGIS Online applications that Permittees use in order to track and report on compliance with MRP 2.0.

The workgroup met regularly in January to June 2022 and several Development Committee members participated. The workgroup developed a survey to poll AGOL users on desired modifications based on current and future uses as related to new MRP 3.0 requirements. In a final report produced in June 2022, the workgroup summarized the survey findings and outlined the following recommendations:

1. Continue to maintain the AGOL workgroup to provide testing, input and direction on technical issues and provide recommendations.

2. Retain current consultant as the program staff liaison to lead the AGOL workgroup.

3. Prioritize and address the list of technical issues identified in the June 2022 report.

4. Conduct review of available alternatives GIS Systems and web applications in order to inform the development of RFPs for the eventual contract completion with PSOMAS, the current AGOL contractor.

FY 2022/23 Planned Activities

The AGOL Workgroup will continue monthly meetings through December 2022, assist in developing RFQ/RFP to solicit AGOL services, and continue to address technical issues and future needs.

<u>Discussions of C.3 Implementation</u>

Development Committee meeting agendas continued to feature, as a last item in each agenda, “open discussion” for the purpose of allowing Contra Costa Permittees to share questions and experiences regarding C.3 implementation, including implementation of Green Infrastructure Plans.

Design and Engineering Assistance to Municipal Staff and to Applicants for Development Project Approvals

Throughout the fiscal year, CCCWP made the services of the Program's staff and consultant, Dan Cloak, P.E., available to its member Permittees and to the community of land development professionals for consultation on C.3 compliance and LID design and construction. Typically, two to ten requests were fulfilled each month, and varied from e-mailed answers to questions, to review of drawings, to participation in local project review meetings.

FY 2021/22 Accomplishments – Green Infrastructure Planning and Outreach

C.3.j - Assistance to Permittees to Plan and Implement Green Infrastructure

Background and Previous Years' Activities

In 2013, CCCWP initiated discussions within BASMAA of Green Infrastructure as a unifying theme for the soon-to-be-reissued MRP 2.0. CCCWP staff and consultants participated in a BASMAA-sponsored Green Infrastructure Work Group that was launched in early 2014. During FY 2014/15, CCCWP staff and consultants helped draft a proposed green infrastructure provision. Following discussions within BASMAA and with Water Board staff, some elements of that draft were incorporated into MRP 2.0 Provision C.3.j.

During FY 2015/16, CCCWP focused on assisting Permittees to implement the early implementation "no missed opportunities" requirements of MRP C.3.j.ii. CCCWP initiated and drafted the BASMAA Development Committee's *Guidance for Identifying Green Infrastructure Potential in Municipal Capital Improvement Projects* and assisted Contra Costa Permittees to implement routine procedures to assess their capital projects.

Over the next three fiscal years (2016-2019) CCCWP staff and consultants, created resources for Contra Costa Permittees to use in preparing their Green Infrastructure Plans. These resources are available on the *Green Infrastructure Planning Resources* page on www.cccleanwater.org and include a template for creating local Green

Infrastructure Plans, example policies, links to planning and design manuals and engineering details, and presentation slides.

During FY 2018/19 CCCWP prepared, with local and State Water Resources Control Board funding, the Contra Costa Watersheds Storm Water Resources Plan (CCWSWRP), which included a database of potential public Green Infrastructure projects. CCCWP prepared, for the Permittees' use, projections and maps of anticipated redevelopment, by using the Metropolitan Transportation Commission's (MTC's) process for creating transportation demand projections using the UrbanSim model created at UC-Berkeley. These efforts were coordinated with development of the Reasonable Assurance Analysis (RAA), submitted with the FY 2020/21 Annual Report. Technical work products included a *PCBs Load Reduction Attainment Tool,* an optimized PCBs Load Reduction Attainment Scenario, and a *Green Infrastructure Cost Estimation Methodology.*

CCCWP staff and consultants' outreach on Green Infrastructure Planning included multiple presentations to Contra Costa County Planning Directors as well as Public Works Directors and municipal engineers through the City/County Engineering Advisory Committee.

FY 2021/22 Accomplishments

Throughout FY 2021/22, CCCWP staff and consultants, and the staff of Contra Costa Permittees, were engaged in the negotiation of Provision C.3 requirements, including GI retrofit requirements in Provision C.3.j. MRP 3.0 TO was released in September 2021 and it mandated that each municipality retrofit a specified acreage of public roadway during the MRP 3.0 permit term. The required acreage was calculated as 1 acre per 50,000 population served, with a maximum of 10 acres per jurisdiction.

In comments submitted on November 15, 2021, CCCWP permittees proposed that these numeric mandates be eliminated, and that the permit incorporate and support Permittees' Green Infrastructure Plans previously approved by the SFBRWQCB instead. SFBRWQCB staff considered these comments, but the MRP 3.0 adopted in May 2022 continued to include an acreage-based retrofit requirement, although the maximum requirement was scaled back from 10 acres to 5 acres per jurisdiction.

In addition to the MRP 3.0 review and negotiations as related to GI retrofit requirements, CCCWP's consultant assisted Permittees staff throughout the year with planning and design questions related to implementation of specific Green Infrastructure projects. Typical issues included ownership and maintenance responsibility for Green Infrastructure facilities that are constructed as part of street frontage improvements that may be required as a condition of land development approvals.

FY 2022/23 Planned Activities

In the upcoming fiscal year, the CCCWP staff and consultants will focus on assisting Permittees in understanding and meeting the new MRP 3.0 GI retrofit requirements. Permittees staff are concerned that the time needed to plan, design, fund, and build Green Infrastructure projects in roadways is typically more than the 5 years allowed by Provision C.3.j.ii.(2)(a). To this end, the Development Committee will plan to hold a forum on C.3.j retrofit requirements at the September 2022 Committee meeting to discuss Permittees' various options for fulfilling the MRP 3.0 retrofit assignments. CCCWP will develop guidance materials based on feedback from this forum.

Throughout the upcoming year, CCCWP staff and consultants will also continue to assist Permittees staff with planning and design questions related to implementation of specific Green Infrastructure projects.

<u>C.3.e./C.3.j. – Regional Alternative Compliance Program</u>

Background and Previous Years' Activities

CCCWP is participating in the Regional Compliance for a Sustainable Bay project, which is supported by an EPA San Francisco Bay Water Quality Improvement Fund grant to CCCWP member agencies San Pablo, Walnut Creek, and Richmond, in addition to Contra Costa County. The objective of the Project is to develop a Regional Alternative Compliance System (System) with the ability to efficiently and cost-effectively improve surface water quality, achieve multiple benefits, and reduce compliance pressures on jurisdictions and entities subject to stormwater quality requirements. It is intended that the System developed will help facilitate required green stormwater infrastructure/low impact development (GSI/LID) across the San Francisco Bay Area with the potential for substantial cost savings, all while meeting Municipal Regional Stormwater Permit and Total Maximum Daily Load (TMDL) water quality goals. This Project will develop a System for Contra Costa County permittees, with the intent that the Project deliverables could be easily adapted for other programs and/or entities subject to the same water quality compliance requirements.

In May 2022, Amanda Booth of the City of San Pablo presented to the CCCWP Management Committee on the draft Summary Report for the Regional Alternative Compliance Program and provided a project status update. The presentation covered objectives, review of the system process, metrics, polluting loading, rainfall, process to collect initial capital payment and ongoing O&M payment. The project performed an extensive legal review of the draft system and all deliverables were reviewed by the project Steering Committee, consisting of members from the City of San Pablo, City of Walnut Creek, City of Richmond, and Contra Costa County. In addition to the progress described, the following meetings were held in FY 21-22 for the project:

- Three Steering Committee meetings.
- Two Technical Advisory Committee meetings, with participants including the Steering Committee members.
- One legal review meeting with many permittees legal representatives attending

FY 2022/23 Planned Activities

- *Final Summary Report*
- *CCCWP Final System Presentation*
- *Stakeholder Workshop #2*
- *Tracking tool development*

<u>C.3.j - Green Infrastructure Design Guidance and Standard Specifications and Details</u>

Background and Previous Years' Activities

Contra Costa municipalities' Green Infrastructure Plans include a commitment to participate in a multi-year countywide interagency process, convened by CCCWP, to facilitate excellence and consistency in the design and construction of Green Infrastructure features and facilities. This process will augment the use of design resources such as the National Association of City Transportation Officials *Urban Street Stormwater Guide* and the San Mateo County *Sustainable Green Streets and Parking Lots Design Guidebook* as common primary resources for determining design elements to be included in streetscape improvements and Complete Streets projects, and the use of CCCWP's *Stormwater C.3 Guidebook* as the primary resource for design specifications and details for constructing Green Infrastructure features and facilities.

A survey of Contra Costa municipal public works directors and capital projects engineers indicated strong support for CCCWP's strategy of compiling design and engineering resources and making them readily available. In addition, respondents were unanimous in supporting countywide interagency collaboration to select and possibly refine details and specifications for use in Contra Costa.

CCCWP staff and consultants initiated the countywide interagency process with a presentation to the City/County Engineering Advisory Committee in January 2020. The next steps are to solicit the participation of City Engineers and capital improvement project managers and to hold a convening meeting.

FY 2021/22 Accomplishments

This project was delayed because of staff shortages and the on-going public health emergency.

FY 2022/23 Planned Activities

CCCWP plans to restart the project in FY 2022/23. Program consultants will draft design drawings, solicit Permittees staff input, and revise and finalize accordingly. The design guidelines will be posted on the CCCWP website and referenced in a future edition of the *C.3 Guidebook*, most likely the 9th Edition as the 8th Edition is anticipated before the design guidelines are finalized.

C.3.j.(4) - Green Infrastructure Outreach and Participation in Processes to Promote Green Infrastructure

Background and Previous Years' Activities

MRP Provision C.3.j.(4) requires Permittees to conduct public outreach, train appropriate staff, and educate appropriate Permittee elected officials. Provision C.3.j.iii. requires the Permittees to track processes and provide information to assist regional, state, and Federal agencies to plan, design, and fund incorporation of Green Infrastructure into local infrastructure projects.

At the countywide level, CCCWP's outreach in previous years (2016-2020) included presentations to the Contra Costa City/County Engineering Advisory Committee (CCEAC), the Contra Costa Planning Directors, the East Bay Municipal Engineers (EBME), and CASQA. CCCWP also provided resources, including templates for plans, documents, and presentations, to assist Contra Costa Permittees with their outreach to local elected officials and the public.

At the regional level, CCCWP supported and participated in regional discussions (2013-2015), which included representatives of the Contra Costa Transportation Authority and Water Board staff that informed the requirements of MRP Provision C.3.j. CCCWP staff and consultants, and staff from Contra Costa Permittees, also participated in BASMAA's grant-funded regional roundtable (2017); that process culminated in preparation of BASMAA's *Roadmap of Funding Solutions for Sustainable Streets* (2018). In February 2021 CCCWP created a 6-minute outreach video, "Rainfall Runoff and Green Infrastructure."

Summary of C.3 FY 2022/23 Planned Activities

- Complete HM Compliance Options Report and begin implementation of recommended option.
- Resolve any outstanding issues related to HM applicability and based on outcomes of interactions with Water Board staff, direct CCCWP's consultant Psomas to revise the draft maps. Publish the maps via website links.

- Develop a "C.3 Update" with an overview of MRP 3.0 changes for Regulated Projects thresholds for distribution to the land development community.
- Produce a memo for Permittees' CIP planning and public works staff informing them of the changes to LID requirements for road construction and maintenance projects.
- Complete updates to the *Stormwater C.3 Guidebook* and publish the 8^{th} Edition.
- Hold a half-day LID workshop for municipal staff and land development professionals.
- Continue the AGOL Workgroup and improve the AGOL platform for CCCWP Permittees.
- Discuss C.3 implementation examples, problems, and issues at Development Committee meetings. Provide consulting on request to assist local staff with review of proposed development projects.
- Develop countywide guidance, to facilitate consistent compliance with and reporting of new requirements to implement LID on road construction and maintenance projects that are regulated in MRP 3.0.
- Convene a GI Retrofit forum to facilitate Permittees' planning process for compliance with numerical retrofit requirements in Provision C.3.j.
- Convene and facilitate a countywide interagency process to facilitate excellence and consistency in the design and construction of Green Infrastructure features and facilities.
- Continue to update pages on the CCCWP website with new Green Infrastructure resources and publications.
- Compile and distribute additional design resources for stormwater facilities, including an online library of photos and other materials related to C.3 implementation.
- Create additional development project LID implementation guidance for municipal project design review teams.
- Prepare guidance, consistent with regional reporting requirements, for Permittee preparation of the FY 2022/23 Annual Report.
- Prepare and review FY 2022/23 Annual Report of Program C.3 activities.

- Assist Contra Costa Permittees as needed with reporting C.3 implementation.

SECTION 4 – PROVISION C.4 INDUSTRIAL AND COMMERCIAL SITE CONTROLS

Introduction

During FY 2021/22, Contra Costa Permittees implemented their business inspection programs as follows:

- Antioch, Clayton, Concord, Danville, El Cerrito, Hercules, Lafayette, Martinez, Moraga, Orinda, Pittsburg, Pleasant Hill, San Pablo, San Ramon, and Walnut Creek contract for business inspection services with local sanitary district inspectors (or POTW inspectors). This institutional arrangement of using local POTW inspectors to conduct municipal stormwater inspections was initiated soon after the CCCWP was issued its first Joint Municipal NPDES Permit in 1993. This arrangement has been praised by SFBRWQCB staff for its effectiveness, and has served as a model for other municipalities throughout California. Business inspections conducted by POTW inspectors are referred to in this Annual Report collectively as the "Group Inspection Program". The CCCWP provides administrative support to the Group Inspection Program. This includes management of the contracts, agreements, invoices and reporting; and, assistance in review and development of annual inspection lists, plans, and goals.
- Brentwood, Oakley, Pinole and CCC currently conduct their own business inspection programs.
- Richmond uses a combination approach for its business inspection program. Stormwater inspections are conducted by municipal staff as well as contracted POTWs inspectors.

FY 2021/22 Accomplishments

During FY 2021/22, CCCWP staff and the CCCWP's MOC assisted Permittees with implementation of Provision C.4 by:

- Administering the CCCWP's Group Inspection Program;
- Hosting an Industrial Commercial Stormwater Inspector Training Workshop;
- Supporting and participating in the Contra Costa Green Business Program; and

- Providing Outreach Resources to Businesses.

The following is a detailed account of each activity listed above:

C.4.b,d - Administering the CCCWP's Group Inspection Program

CCCWP staff administers and manages the various inspection agreements for the Group Inspection Program involving the 16 Contra Costa Permittees and three local POTWs (Central Contra Costa Sanitary District, Delta Diablo, and West County Wastewater District). Administration of the Group Inspection Program includes: 1) coordinating the review of amendments and revisions to the inspection agreements, when necessary; 2) receipt and payment of POTW invoices on behalf of the 16 Contra Costa Permittees; 3) assistance to the Contra Costa Permittees and POTW staff in developing inspection goals, ensuring MRP compliance concerns are integrated into business inspections (e.g., identification and proper management of POC, such as PCBs); 4) training of inspectors to promote consistent inspection services countywide; and, 5) field support to inspectors and municipal staff when needed.

CCCWP staff meets with the participating Contra Costa Permittees and POTW staff annually to: assess the services provided; set inspection goals for the upcoming FY; distribute documentation needed for preparation of municipal annual reports; and, review any special issues or enforcement problems that have occurred.

C.4.e - Stormwater Inspector Training Workshop

The CCCWP hosted one Commercial/Industrial Stormwater Inspection Training Workshop in FY 2021/22. Due to the ongoing coronavirus pandemic, the workshop was held on June 22, 2022, via a Zoom webinar. The workshop had 25 attendees and topics consisted of:

- Stormwater Regulatory Overview of C.4/C.5 Under MRP 3.0;
- Investigating Cross Connections in Storm Water;
- Addressing Encampments of Unsheltered Homeless;
- Enforcement & Coordination with the County District Attorney;

Recordings of the presentation were made available to Permittees and their inspectors following the completion of the workshop.

Green Business Program (GBP)

The CCCWP is one of the largest contributing partners to the GBP and in FY 2020/21, provided $6,000 to support the GBP to assist with carrying out its program mission. The GBP is designed to publicly recognize private businesses and public agencies that take extra steps, beyond baseline compliance with environmental regulations, to prevent pollution and save resources (e.g., conserve water and energy, reduce waste through reuse and recycling, prevent stormwater pollution through good housekeeping practices). This program encourages and helps business managers and inspectors strengthen and sustain the quality of the environment in the County through a collaborative partnership.

Since its inception in 1998, 642 businesses have been certified as Green Businesses in the County. There are currently 212 active Green Businesses. In 2021 the Contra Costa County Green Business Program (CCCGBP) initiated a tiered certification system, including the standard ‘certified’ tier and a streamlined entry-level ‘efficiency’ tier. In FY 2021/2022, 20 businesses were certified by CCCGBP (new ‘certified’: 2 business, new ‘efficiency’: 0 businesses, ‘recertified’: 18 businesses).

Municipal stormwater and POTW inspectors assist the GBP by encouraging business to become Green Business candidates. Each certified Green Business must complete a checklist section with pollution prevention and stormwater specific measures. CCCWP staff members serve on the GBP’s “Partners Committee,” and actively engage in development of the Green Business checklist (i.e., the stormwater pollution prevention section that each business needs to complete before becoming certified as a Green Business).

For FY 2022/23, the Green Business Program will be focusing primarily on the certification of 26 businesses or recertification of 39 businesses, or a combination (1 new business certification = 1.5 recertifications). To accomplish this, the Green Business Program has on staff 1 Hazardous Waste Reduction Manager and 1 Temporary Pollution

Prevention Specialist, with the support of our 24 Green Business Partner cities and agencies.

Providing Outreach and Resources to Businesses

With CCCWP MOC input and direction, CCCWP staff develops and/or updates a variety of business outreach materials, including BMPs brochures and posters, a website, and a telephone hotline. Stormwater inspectors promote these resources during their inspections. In FY 2021/22, CCCWP MOC and Outreach Committees began evaluating brochures for any necessary updates, including but not limited to: updated contact information, development of multiple languages, updates related to MRP 3.0, updates to BMP guidance. The CCCWP has developed recommended revisions and priorities for brochure updates and plans to publish revised brochures in FY 22/23.

Throughout FY 2021/22, CCCWP staff responded to businesses and residents requesting copies of such outreach materials. Business owners use the updated CCCWP website at http://www.cccleanwater.org/business/ to find information on stormwater pollution prevention practices and how they can make their stormwater inspections as easy as possible. Businesses and residents also use the CCCWP's 1-800-No-Dumping hotline to report illegal dumping in their area to help their business communities prosper from a cleaner environment for their customers. A growing awareness of stormwater BMPs has stemmed from use of these resources and this awareness may help to eliminate non-stormwater discharges.

FY 2022/23 Planned Activities

For over 20 years, the CCCWP and local POTWs have consistently maintained a strong Group Inspection Program. Many of the MRP requirements were already part of Contra Costa Permittees' existing business inspection programs. To promote continuous improvement of the municipal inspection programs, the CCCWP MOC established as planned goals for FY 2022/23 the following activities:

- Work to perform inspections and follow-up inspections;
- Update any procedures or program policies in response to MRP 3.0;

- Conduct a training workshop for industrial and commercial stormwater inspectors;
- Provide training on POC source identification and management;
- Develop other outreach materials as needed; and,
- Continue to participate in, and support, the Green Business Partnership.

SECTION 5 – PROVISION C.5 ILLICIT DISCHARGE DETECTION AND ELIMINATION

Introduction

The majority of MRP requirements related to Illicit Discharge Detection and Elimination (IDDE) are being addressed directly by Contra Costa Permittees. The CCCWP MOC oversees IDDE Group Activities.

FY 2021/22 Accomplishments

In FY 2016/17 CCCWP created a robust inventory, updated outreach material for mobile sources and businesses, and completed a mass mailing of the outreach material and an accompanying cover letter to the list of businesses. In FY 2018/19 Permittees reviewed and updated (as necessary) the minimum standards, BMPs, inspection and enforcement strategies, and outreach materials previously developed. The following IDDE Group Activities were initiated or ongoing during FY 2021/22:

- Managed the 1-800-No-Dumping Hotline and Hazmat Incident Reports;
- Joined and participated in the Illegal Dumping Think Tank, a multi-agency effort to combat illegal dumping throughout Contra Costa County;
- Continued with BAMSC and CCCWP activities related to mobile surface cleaners;
- Continued to respond to notifications of potential IDDE incidents and direct notifications to the respective municipality and provide guidance on response; and
- Continued to promote and offer stormwater pollution prevention car washing kits for charity car washing events.

Provided below is a brief summary of each activity listed above.

<u>C.5.c - 1-800-No-Dumping Hotline and Hazmat Incident Reports</u>

The CCCWP continues to operate the 1-800-No-Dumping Hotline. The Hotline is used by the public to report illegal dumping and to obtain stormwater information. All Hotline calls are referred to the appropriate municipality for follow-up and, if necessary, enforcement**.** Calls have been logged since FY 2004/05.

Although updates to the project were initiated in FY 20/21, the CCCWP completed a revision of the 1-800-No-Dumping hotline phone tree and scripts. As a result of the update, callers to the hotline are able to access information about illegal dumping in both English and Spanish languages, as well as learn more information about the CCCWP. In addition, the updates to the hotline phone tree and scripts allow callers to report illegal dumping incidents based on the type of material being dumped, as well as report in-progress dumping events to local dispatchers. In FY 2021/22, 432 calls were made to the 1-800-NO-Dumping hotline and the CCCWP received 103 Hotline calls directly. The difference in the number of calls that the CCCWP receives directly is due to the fact that members of the public are now able to contact local municipal dispatchers directly through the revised Hotline phone tree to notify them of dumped materials or illicit discharge. Additionally, RecycleMore (a Joint Powers Authority, or JPA, that serves West County jurisdictions) in partnership with Republic Services, started a free mattress recycling drop off program in February of 2019 that may be helping to alleviate some of the illegal dumping. The West County jurisdictions include El Cerrito, San Pablo, Richmond, Pinole, Hercules, and the unincorporated County (El Sobrante, North Richmond, etc.).

The most commonly dumped materials reported in these calls include garbage, furniture, mattresses and box springs, sofas and appliances. Other commonly reported dumped materials included car parts, grease/oil, tires, yard and landscaping waste, building/construction debris, tires, and household goods. Each Permittee uses the information from the Hotline to identify problem areas that need to be addressed.

The CCCWP also continues to collaborate with the CCC Hazardous Materials Programs Division (HazMat). HazMat's countywide 24-hour spill response is a vital component of Contra Costa Permittees' IDDE programs. Each month, the CCCWP disseminates the HazMat spill response reports (also known as "Incident Reports") to Contra Costa Permittees. These reports inform each Permittee of HazMat incident responses within their jurisdiction. Contra Costa Permittees use this information to track the type and locations of spills and dumping incidents, and to conduct appropriate follow-up. The Contra Costa Fire Protection District (ConFire) has also established a HazMat response team in Pittsburg (Station 87). The team responds to hazardous materials calls within their jurisdiction or that is called into their dispatch center. ConFire HazMat coordinates with CCC HazMat both for response assistance and to report questionable activities at a business.

More information on each Permittee's IDDE program is provided in the individual Municipal Annual Reports.

CCCWP staff joined the Contra Costa County Illegal Dumping Think Tank in December 2020. Since then, staff have worked collaboratively on educational outreach ideas to educate and dissuade the public from illegally dumping in Contra Costa County. CCCWP staff also assisted in facilitating cities and towns throughout the County to share information and coordinate to reduce illegal dumping. The Taskforce includes the Contra Costa County Public Works, County Health, and County Conservation and Development Departments as well as the County Sherriff's and District Attorney's Office. See Section C.7.c for more information.

C.5.e - BAMSC and CCCWP Activities Related to Mobile Surface Cleaners

BAMSC's Mobile Surface Cleaner Program is a training and certification program for mobile surface cleaners. BAMSC continues to work on these efforts. For a list of activities and accomplishments and additional details, see BAMSC's website for their surface cleaning program[9].

To augment BAMSC's efforts to address mobile businesses, the CCCWP continued with its own set of actions. When incidents are reported through HazMat, CCCWP reviews all notices for issues with mobile businesses. This information may then be disseminated to stormwater inspectors and municipal staff throughout the county. The tracking spreadsheet also serves to identify businesses that have received two or more citations and may warrant an escalation in enforcement action.

9 https://basmaa.org/featured-programs-projects/surface-cleaning-program/

Charity Car Wash Kits

In FY 2007/08, the CCCWP created and implemented a charity car wash pilot campaign to help charity car wash sponsors avoid illegal discharges of wash water to storm drains. The charity car washing campaign included the creation of a brochure and several car washing kits containing: one submersible pump; one 50 ft. electrical extension cord; one 3 ft. X 4 ft. rubber mat; one 50 ft. garden hose; one metal spray nozzle; three collapsible safety cones, and tape. The brochure instructs charity car wash organizers on how to conduct a car washing event without discharging wash water into the storm drain system. The brochure instructs organizations to 1) contact the CCCWP; 2) make sure that charity car washes are legal within their municipality; and 3) use the car washing kit in accordance with the instructions provided.

The charity car wash kits were not used in FY 2021/22. The drop in usage of the kit may be in response to previous drought conditions and may indicate that organizations have transitioned to other types of fundraising activities. The CCCWP will continue to promote and track the use of these charity car wash kits in FY 2022/23.

FY 2022/23 Planned Activities

A focus for CCCWP will be assisting Permittees in addressing any new and ongoing requirements identified in MRP 3.0 provisions. Other planned Program activities for FY 2022/23 include:

- Continuing to staff the 1-800-No-Dumping Hotline;
- Continue to participate in the Contra Costa County Illegal Dumping Taskforce
- Continuing to distribute CCC Hazmat Division's incident response reports to Contra Costa Permittees;
- Promoting the charity car wash kit;
- Revisiting the model IDDE response plan for further review and finalization;
- Assisting Permittee in their responses to illicit discharges and spills; and,
- Providing input and support for BAMSC'S expanded mobile surface cleaners program and associated work efforts.

SECTION 6 – PROVISION C.6 CONSTRUCTION SITE CONTROLS

Introduction

The CCCWP's Development Committee facilitates Contra Costa Permittees' implementation of MRP Provision C.6 requirements and provides direction to CCCWP staff and consultants. During FY 2021/22 the Development Committee was chaired by Joe Camaddo (City of Pittsburgh). John Steere (Contra Cost County) served as vice-chair. Staff from Antioch, Brentwood, Clayton, Concord, Contra Costa County, Danville, Hercules, Lafayette, Moraga, Oakley, Pittsburg, Pleasant Hill, San Ramon, and Walnut Creek were voting members of the Committee. The Committee met monthly throughout the fiscal year, except for November. The November and December meetings were combined to accommodate end-of-the-year holidays.

The Development Committee's FY 2021/22 goals were:

- Facilitate member agencies' compliance with MRP Provision C.6.
- Facilitate member agencies' efforts to reduce erosion and sedimentation, and discharge of pollutants, from construction sites.
- Continuously improve Program outreach and guidance on construction-phase controls.
- Facilitate member agencies' compliance with the Construction General Permit (for agency-sponsored projects)

FY 2021/22 Accomplishments

C.6.f - Construction Inspector Training

To assist Contra Costa Permittees to comply with MRP Provision C.6.f.ii., CCCWP sponsors training for permittee construction inspection staff biennially. The previous biennial training was in FY 2019/20. The FY 2021/22 training was held on March 30, 2022, jointly with the Alameda County Clean Water Program (ACCWP). The workshop was attended by 133 municipal agency staff and 11 consultants. The training was held virtually, on the *GoTo Training* platform; it was recorded and made available to ACCWP and CCCWP members.

The presentations provided foundational C.6 information, pending updates to the Construction General Permit (CGP) and the MRP, and inspection case studies. The inspection case studies drew from experiences three presenting stormwater construction inspectors and was followed up with an extended panel discussion with the participants.

Pre- and post-workshop surveys provided insights into the knowledge of the participants before and after the workshop. The pre-workshop survey had an average correct response rating of 70% that improved to 81% in the post-workshop survey.

Participants were also asked to provide feedback on the Workshop. Seventy-two percent of the attendees (104 out of 143) completed evaluations. Approximately 50% of the attendees stated a preference for future online trainings with the remaining 50% split between no preference and in-person trainings.

The survey also asked “What C.6 questions did you wish were covered, or were not covered enough in this workshop? These responses, which help to identify future training topics and needs, included: additional information on enforcement tools and options for non-responsive contractors; overview of inspection forms and other tools available for inspectors; Water Board contacts; clarification on CGP disturbance thresholds and comparison to MRP C.6 requirements; review of small project Erosion Control Plans.

FY 2022/23 Planned Activities

The following may be implemented during FY 2022/23 depending on Permittee requests and availability of resources:

- Assist Contra Costa Permittees to update enforcement response plans as needed. Review and update warning notice forms and guidance for use.
- Investigate the need to update construction inspection reporting forms and update as necessary. Continue providing support as needed for use of forms. Assist Contra Costa Permittees to respond to Water Board requests for submittal of inspection data.
- Assist Contra Costa Permittees with construction general permit (CGP) compliance and reporting requirements as needed. Discuss CGP compliance and

reporting requirements at Development Committee meetings and Provide updates on changes to the CGP.

SECTION 7 – PROVISION C.7 PUBLIC INFORMATION AND OUTREACH

Introduction

The CCCWP Public Information and Participation (PIP) Committee, with assistance from CCCWP staff and consultants, is responsible for overseeing the development of materials and products, information dissemination, marketing and public outreach related to stormwater pollution prevention. Starting in FY 2019/20 and continuing in FY 2021/22 the CCCWP Administrative Committee joined the PIP Committee as voting members in order for the PIP Committee to have sufficient voting members. Most of the public information and outreach requirements in the MRP are contained in Provision C.7; however, additional outreach activities are required or encouraged in other MRP provisions as well. The CCCWP PIP Committee works to identify and coordinate the public information and outreach mandates conducted as a group and/or regionally through BAMSC's PIP Committee. Attachments 1.2 and 1.3 provide a list of CCCWP representatives to BAMSC's PIP Committee, and participation and attendance at CCCWP PIP Committee meetings, respectively. In FY 2021/22, Melinda Harris (CCC Flood Control District) served as Chair and Kerry Parker (City of San Ramon) served as Vice-Chair, respectively, of the CCCWP joint PIP/Administrative Committee. The CCCWP's public information and outreach budget was supplemented by CalRecycle Oil Payment Program (OPP) Grant funds.

During the 2021/22 fiscal year the Contra Costa Clean Water Program executed a variety of projects to engage the community and youth in clean water efforts. These accomplishments include the creation of an educational video to be used in coordination with partner agencies, on social media, and featured on the CCCWP website[10]. During FY 2021/22, work began on a second educational video that will be available in FY 2022/23. Both videos incorporate animations and subject matter experts to illustrate the importance of community engagement and clean water. Additionally, CCCWP expanded its social media tactics by incorporating the use of a Snapchat filter to target the youth

10 https://www.cccleanwater.org/

demographic, captured 360 VR videos to be used on social media, and published paid social campaigns to amplify the program's call to action. Through the expansion of the program's efforts, CCCWP has seen growth in visitors to the CCCWP website, likes on the program's Facebook page, and overall engagement on Instagram. For further details of the CCCWP's social growth, see *C.7.c Stormwater Pollution Prevention Education.*

The remainder of this section documents public education and outreach activities conducted collectively in Contra Costa County.

FY 2021/22 Accomplishments

<u>C.7.b - Outreach Campaigns</u>

A paid likes social media campaign ran from December 2021 – April 2022 to expand the program's efforts and reach on Facebook. The content shared included imagery of Contra Costa County to encourage residents to engage with the ad. The paid likes campaign increased Facebook likes by 19% and boosted post engagement for the five-month period. Additionally, the ads published linked viewers to the program website which led to 35% of new visits via Facebook. The completion of the paid likes campaign resulted in a 59% increase in likes by women, with the majority falling in the 25-34 age demographic. Overall, the campaign reached 50,489 people in the local area.

Additional promoted posts were delivered throughout the fiscal year expanding the program's message and highlighting key pollutants of concern.

Content promoted on Facebook resulted in:

- Reach: 97,779
- Impressions: 226,990
- Likes: 1,797
- Engagement: 2,515
- Clicks: 598
- Video Views: 5,821

Website Analytics:

- Sessions: 18,428 (+33% from FY 2020/21)
- Users: 14,000 (+35% from FY 2020/21)
- Organic Sessions: 3,695

Instagram Analytics:

- Followers: 326 (+10.8% from FY 2020/21)
- Likes: 383

C.7.c - Stormwater Pollution Prevention Education

- Working with Sagent, CCCWP utilized links on paid and organic social media content to drive users to the website. Video content was also created and shared with partners, to drive traffic to the CCCWP website. These tactics directed 14,000 users to the website, 98% of which were new users.
- CCCWP staff worked with Sagent to implement improvements to the CCCWP website in order to make it more consumer-friendly and prioritize new content. Updates included revising the event calendar to be an organization-focused current events page and placing the Illegal Dumping video (created in FY 2021/22) on the website's front page. Additionally, Sagent submitted monthly newsletters to the website editor to be placed on the front page, ensuring residents can locate the document quickly.
- In addition, the CCCWP provides a 1-800-No-Dumping Hotline where people can call and report illegal dumping, as well as obtain stormwater information. Calls regarding illegal dumping are forwarded to the appropriate Permittee for follow-up as needed. Further details regarding these calls are provided in Section 5 of this Volume 1 report.
- CCCWP continued IPM engagement through Our Water Our World (OWOW) outreach in retail locations as well as online workshops for the public; continued outreach to school-age children with the OPP/Mr. Funnelhead programs; and utilized the watershed diorama at three community events and one staff training.

C.7.d - Public Outreach and Citizen Involvement Events

Contra Costa Permittees conducted several public outreach efforts and citizen involvement events as a group in order to reach a broad spectrum of the community with both general and specific stormwater runoff pollution prevention messages. Several efforts were conducted countywide, and are described below:

- **Social Media** – CCCWP expanded its use of social media to include Instagram and YouTube in FY 2019/20. In FY 2021/22, CCCWP continued to utilize Facebook, Instagram, and YouTube and expanded its use of social media to include Snapchat. Sagent continued to use an expanded social media approach to promote involvement at events. Utilizing Facebook and Instagram they shared Permittee and partner recommendations for public outreach and community involvement events. YouTube (https://www.youtube.com/channel/UC0x-EX-fgMRk9DXfGeE9Q_w/videos) now serves as the host library as the CCCWP video series content is developed.

    Facebook[11] & Instagram[12] – CCCWP published content about integrated pest management, proper disposal of trash and pet waste, and safely consuming fish caught in local water bodies several times a week. The social media posts also highlighted community-based organizations' stormwater pollution prevention events. Content spotlighted organizations that focus on youth education, integrated pest management, and proper disposal.

    Snapchat – CCCWP created a local Snapchat geo-filter for organizations to use during the 2021 California Coastal Clean-Up Day events in Contra Costa County.

    YouTube[13] – The updated Illegal Dumping video was published on January 10, 2022. Since it's posting, the video has received 5,821 views across YouTube, Instagram, and Facebook. The video can be viewed at https://youtu.be/7CaPFM_9CqQ.

- **Bringing Back the Natives Garden Tour** – This public outreach and citizen involvement event promotes the idea of water-saving, pesticide-reduced gardening through planting of native species. Contra Costa Permittees sponsored the 2022 18th Annual Bringing Back the Natives Garden Tour, which included both

11 https://www.facebook.com/cccleanwaterprogram/

12 https://www.instagram.com/cccleanwater

13 https://www.youtube.com/channel/UC0x-EX-fgMRk9DXfGeE9Q_w

virtual[14] and in-person tours. The online tours took place on Saturday, April 16 and Sunday, April 17, 2022. 968 unique viewers watched the Saturday tour, and 577 unique viewers watched the Sunday tour. The in-person tour was a two-day event this year for the first time in the program's history. Bayside gardens (Pinole to Fremont) were open on Saturday, April 30, and Inland gardens (Martinez to Livermore, including Orinda and Moraga) were open on Sunday, May 1, 2022. There were 50 gardens open on the in-person tour across the two days and 10,816 garden visits were made. A total of 3,036 people registered for the events and 40% of registrants participated in both the online and in-person tours. There have been more than 100,000 views of the Tour's YouTube channel to date and the channel has nearly 2,000 subscribers. For a detailed summary about the Tour, see Attachment 7.1 of this Volume 1 report.

- **OWOW** – As in past years, Contra Costa Permittees partnered with the OWOW Program to help raise awareness of the connection between pesticide use and water quality, and to provide information to consumers (at the point of purchase) about IPM and less-toxic alternatives that reduce or eliminate impacts to water quality. Thirty-four stores participated in this public outreach program, with 92 store staff receiving formal training during 23 OWOW store trainings. Three in-person outreach/tabling events reached over 65 people, while eight webinars reached over 700 attendees. Additionally, webinars recorded during FY 2020/21 continued to be viewed online. For a detailed report on this year's efforts, see Section 9 and see Attachment 9.1 of this Volume 1 report.
- **CCCWP Current Events** – Due to reduced public events during the COVID-19 pandemic, the CCCWP event calendar shifted to a list of organizations that may host watershed-related community events, activities, and volunteer opportunities on the CCCWP Current Events webpage at https://www.cccleanwater.org/community/get-involved/events. A secondary goal in maintaining the Current Events page is to increase traffic to, and use of, the

14 https://www.youtube.com/c/BringingBacktheNativesGardenTour

CCCWP website and its information resources to increase awareness of stormwater quality and pollution prevention practices.

- **Volunteer Field Monitoring Equipment Maintenance Support** – CCCWP budgets for an annual contribution of $1,000 to maintain field monitoring equipment used by creek groups and volunteer field monitors. This equipment is housed by the CCC Department of Conservation and Development.

C.7.e - Watershed Stewardship Collaborative Efforts

- **Contra Costa Watershed Forum (CCWF)** – CCCWP staff attends and participates in CCWF meetings, an open committee of some 50 organizations, including state and local agencies, local non-profit environmental and education organizations, community volunteer groups, and private citizens. The CCWF operates on the premise that actions in a watershed are inter-related, and that broad participation and cooperation is needed to effect change. Concerned with urban, suburban, and rural areas in the San Francisco Bay Delta area, the CCWF facilitates local agency and citizen collaboration, fosters innovative strategies for stewardship and protection of watershed resources, and encourages regional capacity building in Contra Costa and neighboring areas.
- **Green Business Program** – CCCWP continued to provide staff support and financial assistance to the GBP to help with its outreach activities to the business community, including the certification and recertification of Green Businesses. CCCWP continues to be a major contributor to the GBP. Strategic meetings are held quarterly. For more details on the GBP, see Section 4 of this Volume 1 report.

C.7.f - School Age Children

This provision requires Permittees to individually or collectively implement outreach activities designed to increase awareness of stormwater and/or watershed messages in school-age children. In FY 2021/22, the Contra Costa Permittees, individually and collectively, implemented several youth-oriented outreach programs, which are discussed below:

- **Social Marketing** – CCCWP's monthly social media content shares helpful and easy tips that Contra Costa County youth can use at home and at school to engage in pollution prevention activities. Sagent utilizes user-friend language and creative content that engages this demographic through CCCWP social media accounts.

  Snapchat Filter – CCCWP connected with the youth of Contra Costa County through the development and use of a Snapchat geo-filter for local cleanup events during the 2021 California Coastal Clean-Up Day events. This filter focused on spreading awareness of the importance of properly disposing of litter to prevent it from reaching local waterways. To participate, Snapchat users logged into the app could take a photo of their coastal clean-up activities and then swipe through the available filter options to the CCCWP-provided filter. The filter was promoted with a paid ad on social media, targeting students to use the filter, and information about the filter was shared with all local event hosts.

- **OPP Grant & Mr. Funnelhead** – The OPP strives to reach across all age groups, but places particular emphasis on youth for two reasons: (1) teaching positive behaviors to young children early can result in the behavior being a part of their daily lives; and (2) children can influence behavior change in their parents and other adults. Several Contra Costa Permittees provided their allocation of OPP grant funds to the CCCWP for implementation of an ongoing, countywide comprehensive effort in FY 2021/22. There are several components of the OPP: 1) certifying and recertifying used-oil recycling centers throughout the County; 2) providing educational programs targeted to elementary schools throughout the County; 3) providing outreach at community events countywide; 4) providing programming to educate and entertain people about the importance of recycling used motor oil; and 5) providing outreach through a cable advertising component. A "Mr. Funnelhead" website exists as an additional outreach tool at www.funnelhead.com. A summary of OPP activities is reported below:

Used Oil Collection Center Certification - There are 67 certified oil collection sites in CCC, 12 of which were visited by CCCWP's OPP Grant consultant during FY 2021/22. At the 12 sites visited in FY 2021/22, there were 1,560 used filters and 4,860 gallons of oil recycled.

"The Filter Crush" - During FY 2021/22, the CCCWP's Used Oil Recycling Program continued to share Public Service Announcements (PSAs) entitled "The Filter Crush" with local channels in Contra Costa County. The PSAs are available in English and Spanish and were created in cooperation with the West Contra Costa Integrated Waste Management Authority (also known as RecycleMore). They focus on oil filter recycling and feature Ruby Lopez, a bilingual professional actress who has worked throughout the Bay Area. In the PSAs, Lopez plays an auto mechanic who shows how much oil can be left in an oil filter after draining, followed by a shot of an oil filter being crushed in a clear filter crusher to show the amount of residual oil. These PSAs can be seen at: https://youtu.be/BulmUlfSvxQ (English) and https://youtu.be/6-L0OjJ4u9U (Spanish).

Mr. Funnelhead - Matt Bolender, CCCWP's OPP Grant consultant, uses the Mr. Funnelhead character to provide educational outreach. Now in its 26th year, the Mr. Funnelhead School Education Program virtually visited 11 schools and educated 3,695 students via Zoom presentations about the importance of used oil and filter recycling. This year's show, "It Came from Boggy Lake," featured several actors portraying the characters Dastardly Dana, Slimer, and Mr. Funnelhead. Featuring professional actors, lighting, and sound, the show has been the most talked about and memorable part of the program each year. Conducting the program over Zoom had its constraints, but it allowed students from all over the County to be educated via this unique experience. Clips from this year's performances can be viewed at: https://youtu.be/qMEOyh2JLqQ and https://youtu.be/drWnqggliV0.

Additional Outreach - Another highlight of the program was outreach to children and adults about the importance of recycling used motor oil and filters with the use of a diorama/biosphere. The diorama/biosphere captivates children and adults through its use of flowing water and figurines to provide a unique focus on recycling motor oil and filters. Over the past 11 years, OPP has created several stories using the diorama/biosphere that intrigue audiences between the ages of 4 and 80 and infuse them with information about the importance of recycling of used motor oil and filters. This year the program educated 3,125 children and adults at 12 events about this important subject.

Annual Art Contest - Mr. Funnelhead also holds an annual art contest where children incorporate Mr. Funnelhead into their own message about recycling used oil. Prizes are given to the top three artists. To see this year's contest winners and their artwork, visit http://www.funnelhead.com.

- **CCCWP Watershed Diorama** - The CCCWP's Watershed Diorama is provided to, and used by, Contra Costa Permittees and stakeholder organizations for youth-education programs and various public outreach events. The Watershed Diorama is a hands-on model which shows how rain becomes stormwater runoff carrying dirt, garbage, and other pollutants found in the urban environment into storm drains, which flow untreated to local creeks, the Delta, and the Bay. In FY 2021/22, the diorama was reserved for three public outreach events and one staff training, as follows:

Table 7-1: Watershed Diorama Use

Use Date	Entity	Event
8/5/2021	Contra Costa County	Maintenance Training
4/8/2022	City of Oakley	Science Week
4/22/2022	City of San Pablo	Outreach

5/5/2022	Contra Costa County	CC Block Party

FY 2022/23 Planned Activities

- Increase awareness of and expand partnership with Friend of the Creek organizations and clean-up events with shared calendars, social media posts, e-mail blasts.
- Continue to expand social media channels and promote involvement at events.
- Increase awareness of the Bringing Back the Natives Garden Tour partnership including program ad and recognition.
- Continue to generate awareness and participate in the Mr. Funnelhead Program targeting Oil Recycling messaging.
- Expand partnerships and shared outreach opportunities with Kids for the Bay, East Bay Regional Park, Contra Costa County Public Works and the Contra County Resource Conservation District.
- Finalize and share the Fish Risk video on the CCCWP YouTube channel, website, and social media pages.
- Continue to provide outreach to school-age youth through targeted social media posts and consider new ways to reach this demographic.
- Review and update CCCWP stormwater pollution prevention brochures and create new brochures as needed.
- Launch a paid media campaign in partnership with Caltrans' "Let's Change This to That" campaign, which focuses on reducing the amount of litter that ends up in waterways. The paid media campaign will include digital, social, radio, and out-of-home ads.

SECTION 8 – PROVISION C.8 WATER QUALITY MONITORING

Introduction

Reporting on implementation of the Provision C.8 Water Quality Monitoring requirements is provided in the *Urban Creeks Monitoring Report, Water Year 2021* (2021 UCMR) submitted to the SFBRWQCB and CVRWQCB on March 31, 2022. This report is available at https://www.cccleanwater.org/monitoring/monitoringreports.

Pyrethroid pesticide and toxicity monitoring conducted since 2012 in compliance with Provision C.8.g fulfilled requirements of the Central Valley Water Board's TMDL for Pyrethroid Pesticides, applicable to East County Permittees (the Cities of Antioch, Brentwood, and Oakley, and portions of unincorporated County and the Flood Control District locates within Region 5) in WY 2021.

SECTION 9 – PROVISION C.9 PESTICIDES TOXICITY CONTROLS

Introduction

BAMSC and CCCWP staff, consultants and MOC members provided the following assistance to Contra Costa Permittees' efforts to reduce pesticide toxicity in local creeks during FY 2021/22:

- Tracking and participating in pesticide regulatory initiatives;
- Promoting opportunities for training events for municipal employees and contractors on IPM and similar programs;
- Providing outreach to residents and the general public on less-toxic pesticides and proper pesticide use and disposal; and
- Coordinating with, and reporting to, the CCC Agricultural Commissioner on improper pesticide use.

FY 2021/22 Accomplishments

CCCWP's MOC provides a forum for Contra Costa Permittees to share information on common issues and lessons learned related to reducing pesticide toxicity in the County's urban creeks. A summary review of activities conducted as a Group Activity is provided below.

<u>C.9.b - Train Municipal Employees on IPM Practices</u>

CCCWP did not sponsor workshops for municipal staff and their contracted employees during FY 2021/22. However, throughout the FY, CCCWP notified Permittees about IPM trainings being conducted in the Bay Area and recommended that if Contra Costa Permittees have municipal staff that apply or use pesticides and need training, to sign up for these workshops.

C.9.d - Interface with CCC Agricultural Commissioner

During FY 2021/22 at the June MOC meeting, Deputy Agriculture Commissioner Beth Slate from the Contra Costa County Department of Agriculture made a presentation to the Committee. Ms. Slate discussed headquarter inspections and annual audits of municipal facilities, as well as pesticide disposal practices including public interface and outreach.

CCCWP contacted Deputy Agriculture Commissioners Beth Slate and Erin Herbst to inquire as to whether there had been any reports of improper pesticide usage that occurred in FY 2021/22. It was reported that there had been no violations of pesticide use affecting stormwater.

C.9.e - Public Outreach

- Point of Purchase Outreach: The CCCWP funds and participates in the OWOW Program, which provides educational outreach directly to the consumer/user at the point of purchase (i.e., in the store). The OWOW Program is implemented both regionally and locally. Further details regarding regional implementation of the OWOW Program are provided in Attachment 9.1 *Contra Costa Clean Water Program, Our Water Our World Store Partnership Program Report, 2021-2022.*

  Locally, the CCCWP distributes OWOW educational literature in stores for customers and classes/presentations for the public at community events. CCCWP staff promotes OWOW through its website and direct interactions with citizens, schools, and businesses. In addition, many Contra Costa Permittees provide educational flyers at their city of county offices (public counters). A total of 34 Contra Costa stores participated in the OWOW Program in FY 2021/22. All 34 stores were set up with literature racks, fact sheets, and shelf talkers, as well as QR code posters on display.

  One of OWOW’s primary outreach tools is to set up a table where they can promote eco-friendly products, answer customer questions and work with them in the aisle on product choices. This is a chance to reach customers at point-of-purchase. They also set up tables at community events to introduce the OWOW program to a broader audience, promote eco-friendly methods and products, and explain how the fact sheets and shelf talkers can help in product selection. This year, OWOW was able to provide formal store trainings, tabling events, as well as led a series of online webinars in order to stay in touch with the public and the store customers. In addition, OWOW developed modern alternatives to the printed fact sheets by developing a poster with QR codes available for each fact sheet, which was placed in stores alongside each of the OWOW informational racks.

- Store Staff Training: Training on the OWOW Program was provided to staff at 23 key stores in FY 2021/22. There were 92 staff trained at formal training events. Trainings included information on:
    - An OWOW partnership program overview,
    - Pesticide pollution and impacts on water quality through storm drains and sewers; pesticides of particular concern; how and where to dispose of pesticide products no longer wanted.
    - Where to dispose of local household hazardous waste.
    - How to identify common beneficials and pests; planting to attract beneficials; new/invasive pests/diseases to watch for.
    - Benefits of organic fertilizers, compost and mulch; nutrient run-off; chemical salt buildup from fertilizers; the importance of building up the soil foodweb.
    - Techniques for managing specific pest problems and the eco-friendly products they carry for these pests; active ingredients and how eco-friendly products work, and information on invasive pests.
    - Tips for working with customers on how to choose and use products.
    - How to find and use on-line resources, including the OWOW 'Ask the Expert' feature and the UC IPM website.

  Each training participant received a packet of information and resources, including:

    - The Mac's Field Guide Good Garden Bugs of California
    - Monthly Pest-at-a-glance Calendar

- How Less-Toxic Products Work
- Applying Beneficial Nematodes
- Lose Your Lawn the Bay-Friendly Way (sheet mulching instructions for lawn reduction projects)
- *10 Most Wanted Bugs in Your Garden* brochure
- OWOW pocket guides
- Sheet mulching instructions
- Additional pest management information sheets on: citrus leaf miner, codling moth, dormant spraying, whitefly, beneficial nematodes, and bed bugs
- OWOW Resources (websites, books, and the location of local Household Hazardous Waste Collection Sites.)

Trainees also receive pre- and post-training surveys to determine effectiveness of training on the connection of pesticides to water quality and proper disposal of pesticides.

- Webinars: Given the constraints of COVID-19, OWOW successfully implemented a 8 free webinars on a variety of topics, which were very successful and reached an audience of over 1200 participants. Topics included: fall planting tips and garden maintenance, organic rose care, eco-friendly pest management, and maintaining landscapes in a drought. In addition to the successful webinars provided over the course of FY 21/22, OWOW continued to receive views and engagement on previous webinars delivered in FY 20/21. Virtual education continues to provide reach and engagement with the public beyond individual in-person tabling events.
- OWOW as a training tool: In FY 21/22 Sloat Garden Centers began encouraging associates to watch additional OWOW educational webinars that are archived on the website and on the OWOW YouTube channel. Throughout FY 21/22, 45 associated continued their education and training by viewing recorded webinars.
- Tabling Events: Although the OWOW program continued to experience challenges associated with COVID19, the program was able to provide 3 in-person tabling events that reached and engaged with 81 people. Typical topics at the tabling

events included eco-friendly pest solutions, sheet mulching techniques, and integrated pest management.

- Social Media: In FY 21/22, OWOW assisted the CCCWP in posting nine (9) bilingual “OWOW IPM Tips” across CCCWP social media accounts.
- Outreach to PCOs: CCCWP performs outreach to PCOs by mailing PCOs a letter and flyer and encouraging them to attend the annual Pesticide Applicators Professional Association (PAPA) seminar held in Contra Costa County. The FY 2021/22 seminars were all held as webinar-based trainings.

C.9.f - Track and Participate in Relevant Regulatory Processes

In recent FYs, the CCCWP, along with other BAMSC members and stormwater programs statewide, invested considerable efforts in tracking and participating in the USEPA and Department of Pesticide Regulation actions related to urban uses of pesticides to reduce the amount of toxic pesticides impacting urban waterways. The most recent efforts in this area may be found in CASQA’s *Pesticides Subcommittee Annual Report and Effectiveness Assessment 2021-2022* submitted separately by CASQA on behalf of Contra Costa Permittees and included in the attached Regional/Statewide Supplemental Reports.

FY 2022/23 Planned Activities

Planned activities for FY 2022/23 may include:

- In conjunction with the MOC, determining if training of municipal employees and their contractors on landscape and/or structural IPM should be conducted by CCCWP or left to the individual Contra Costa Permittees;
- Continuing to support regional and CCCWP’s OWOW Programs; continuing to track and participate in relevant pesticide-related regulatory processes and initiatives through BAMSC and CASQA;
- Continuing to provide outreach to PCOs by promoting PAPA seminars held in CCC or identifying other meaningful ways to promote IPM to PCOs;
- Continuing to interface with County Agricultural Commissioners; and

SECTION 10 – PROVISION C.10 TRASH LOAD REDUCTION

Introduction

In FY 2021/22, CCCWP directed its efforts to address Provision C.10 requirements in three areas to assist Contra Costa Permittees in meeting their trash load reduction requirements. These efforts included participating in the regional and statewide efforts on trash-related issues affecting stormwater; continuing to coordinate efforts with Caltrans to identify mutually beneficial projects that reduce trash loads; and communications with Regional Water Board staff regarding MRP 3.0 trash provisions.

FY 2021/22 Accomplishments

Participating in the BAMSC Trash Subcommittees and Statewide Efforts

CCCWP staff participate in the BAMSC Trash Subcommittee and MRP 3.0 Workgroup. CCCWP staff is participating in the Ocean Protection Council's *Statewide Trash Monitoring Methods Project* being conducted in collaboration with the State Water Board, the San Francisco Estuary Institute, and the Southern California Coastal Water Research Project. CCCWP is a stakeholder in this endeavor and will be attending future stakeholder meetings as they occur.

Coordinating Trash Reduction Efforts with Caltrans

In FY 2021/22, CCCWP continued to serve as a liaison between Caltrans and Contra Costa Permittees. CCCWP provided information to Permittees on the criteria that Caltrans required for candidate projects to qualify for assistance and identified factors that would help a project's overall ranking and what minimum information they should include with their project submittal. In FY 2021/22 several Contra Costa Permittees submitted potential collaborative projects with Caltrans, and worked to move forward on agreements.

FY 2022/23 Planned Activities

CCCWP staff and consultants will continue to coordinate and support Contra Costa Permittees in refining and implementing their *Long-Term Trash Load Reduction Plans*.

Furthermore, CCCWP will work to support Contra Costa Permittees in meeting MRP 3.0 trash load reduction requirements. Support will include further refinement, development and training of the countywide GIS Platform and associated applications; continued involvement in regional Trash Committees and stakeholder meetings from the Ocean Protection Council; exploring project and funding opportunities with Caltrans; and developing regional reports in response to MRP 3.0 Trash Load Reduction requirements.

SECTION 11 – PROVISION C.11 MERCURY AND METHYLMERCURY CONTROL PROGRAM

Introduction and Overview of Countywide Implementation of Two TMDLs

Provision C.11 of the MRP Implements the TMDL for Mercury in San Francisco Bay, applicable to Permittees located within Region 2[15]. Provision C.16.5.h implements the TMDL for Mercury and Methylmercury in the Sacramento San Joaquin River Delta, applicable to East County Permittees located within Region 5. CCCWP coordinates mercury monitoring, reporting of control measures, and assessing effectiveness on a Countywide level to be responsive to both applicable TMDLs and associated permit provisions.

MRP Provision C.11 requires that the Permittees implement a mercury control program including source control, treatment control, and pollution prevention actions to make substantial progress toward achieving the urban runoff mercury load allocations established for the TMDL.

The TMDL implementation plan calls for attainment of the urban runoff load reduction goals by February 2028. Mercury TMDL compliance can be demonstrated through three different approaches[16]:

1. Show that mercury concentrations in suspended sediments discharged by urban stormwater are below 0.2 milligrams per kilogram (mg/kg) (i.e., monitoring-based compliance demonstration using grab and / or composite sampling to measure mercury and suspended sediment concentrations).

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[15] Permittees located in Region 2 (the San Francisco Bay Basin) include the Cities of Clayton, Pittsburg, Concord, Martinez, Pleasant Hill, Walnut Creek, San Ramon, Lafayette, Orinda, El Cerrito, Richmond, San Pablo, Pinole, Hercules, the Towns of Danville and Moraga, and portions of unincorporated Contra Costa County and the Flood Control District. The Cities of Brentwood, Antioch, or Oakley, and portions of unincorporated County and the Flood Control District (known as East County permittees) are located in Region 5, (the Central Valley Basin).

[16] See Order No. R2-2015-0049 as amended, Attachment A (Fact Sheet) Page A-105 for definition of three pathways to comply with the San Francisco Bay Mercury TMDL

2. Show attainment of the WLA as a rolling 5-year average (i.e., through monitoring flows and event mean mercury concentrations, combined with numeric modeling applied to unmonitored storms).
3. Demonstrate the required load reductions can be achieved over time by a program of source control and treatment measures, with quantitative evidence of the load reduction benefits of control measures applied.

CCCWP Permittees in Region 2 are pursuing the third pathway for compliance with the San Francisco Bay Mercury TMDL. The Implementation Plan, Schedule, and Reasonable Assurance Analysis for Achieving PCBs and Mercury Total Maximum Daily Load (TMDL) Load Reduction Goals (TMDL Implementation Report) was provided with the Fiscal Year 2019/20 Annual Report. The waste load allocation (WLA) applicable to urban runoff discharges from CCCWP Permittees in Region 2 is 11 kg/yr. The TMDL Implementation Report parses the 11 kg/yr WLA into a load reduction goal that focuses on MRP areas where Permittees will implement mercury control measures.

East County Permittees completed and submitted a Methylmercury Control Study Report to the Central Valley Water Quality Control Board in FY 2018/19. That report established the requirements of MRP Provision C.16.5.h when Order No. R2-2019-0004 amended the MRP to include East County Permittees. Accomplishments under Provision C.16.5.h are described separately in Section C.16.5 below (Central Valley Provisions Applicable to East County Permittees).

CCCWP Permittees are implementing a coordinated Countywide approach to both the Region 2 Mercury TMDL and the Region 5 Methylmercury TMDL. Both TMDLs result in control measures focused on pollution prevention, source control, and long-term implementation of green stormwater infrastructure through development and redevelopment, with some incremental contribution from public green stormwater infrastructure projects as funding and planning constraints allow.

FY2021/22 Accomplishments

C.11.a - Implement Control Measures to Achieve Mercury Load Reductions

MRP 2.0 Provisions C.11.a.iii.(2) and C.12.a.iii.(2) require reporting a list of the Watershed Management Areas where mercury and PCBs control measures are currently being implemented and those in which new control measures will be or have the potential to be implemented during the term of this permit, along with the specific control measures and an implementation schedule. Although many of the control measures may be selected primarily for the purpose of achieving PCBs load reductions during this permit term, substantial mercury load reductions may result as a tangential benefit and will be accounted for in tracking mercury load reductions. A *Mercury and PCBs Watershed/Management Areas*, *Control Measures, and Load Reduction – Update 2022* report (WMA report) was prepared by the CCCWP to fulfill the requirement of MRP Provision C.11.a.iii.(3) and C.12.a.iii.(3) for updating the list of control measures reported annually as necessary to account for new control measures. This WMA report is provided as Attachment 11.1 and summarized in Section 12 below under provision C.12.a.

C.11.b - Assess Mercury Load Reductions from Stormwater

MRP Provision C.11.b and C.12.b require the Permittees to develop and implement an assessment methodology and data collection program to quantify mercury and PCBs loads reduced through implementation of pollution prevention, source control, and treatment control measures. These provisions also require the Permittees to submit, in 2018 and subsequent Annual Reports, refinements to the mercury and PCBs load reduction assessment methodology to assess load reductions in the next permit term. Those refinements are documented in the BASMAA Source Control Load Reduction Accounting for Reasonable Assurance Analysis Report, which was submitted with the Fiscal Year 2019/20 Annual Report. Comments were received from the Regional Water Board on the BASMAA Source Control Load Reduction Accounting for Reasonable Assurance Analysis report in April 2021. A revised report was approved by the Executive Officer approval in January 2022 and is provided as Attachment 11.2. The regional Interim Accounting Methodology for TMDL Loads Reduced report, approved by the Executive

Officer in May 2017, was used to report mercury load reductions in Attachment 11.1 (the WMA Report).

C.11.c - Plan and Implement Green Infrastructure to Reduce Mercury Loads

Provision C.11.c requires Contra Costa Permittees located in Region 2 to implement green stormwater infrastructure projects sufficient to collectively achieve a “mercury loads reduction performance criteria” of 9 g/yr by 2020. This was achieved and documented in the Fiscal Year 2019/20 Annual Report. Provision C.11.c further requires a demonstration of the amount of mercury that will be reduced by green stormwater infrastructure by the years 2030 and 2040. That requirement was fulfilled by the Clean Water Program Reasonable Assurance Analysis Report, which was submitted with the Fiscal Year 2019/20 Annual Report. Finally, Provision C.12.c requires a demonstration that all MRP Permittees collectively will attain 10 kg per year mercury load reductions via green stormwater infrastructure by the year 2040. The RAA Report documented the extent and cost of green stormwater infrastructure that would be required to achieve the proportion of that regional goal that would be applicable to Contra Costa Permittees located in Region 2.

C.11.d - Prepare Implementation Plan and Schedule to Achieve TMDL Allocations

MRP Provision C.11.d requires the Permittees to prepare a plan and schedule for mercury control measure implementation and an RAA demonstrating that sufficient control measures will be implemented to attain the mercury TMDL WLAs by 2028. The TMDL Implementation Report and RAA Report submitted with the Fiscal Year 2019/20 Annual Report fulfilled this requirement.

C.11.e - Implement a Risk Reduction Program

Refer to Section C.12.h for information on implementation actions related to this permit requirement.

SECTION 12 – PROVISION C.12 POLYCHLORINATED BIPHENYLS CONTROLS

Introduction

MRP Provision C.12 implements the urban runoff requirements of the San Francisco Bay PCBs TMDL. It requires the Permittees located in Region 2 to implement a control program for PCBs that includes source control, treatment control, and pollution prevention control measures where benefits are most likely to accrue (i.e., focused implementation). East County Permittees are exempt from Provision MRP C.12. The San Francisco Bay PCBs TMDL's urban runoff WLA for CCC is 0.3 kg/yr. The TMDL Implementation Report (submitted with the Fiscal Year 2019/20 Annual Report) parsed this WLA into a load reduction goal that focuses on MRP areas where Permittees will implement PCB control measures.

FY 2021/22 Accomplishments

C.12.a - Implement Control Measures to Achieve PCBs Load Reductions

MRP Provision C.12.a., similar to Provision C.11.a., requires the Permittees to report the Watershed Management Areas where PCBs control measures are currently being implemented and where new control measures will be implemented during the term of this permit, the specific control measures, and an implementation schedule. The Permittees are required to update the list of control measures annually as needed.

A *Mercury and PCBs Watershed/Management Areas*, *Control Measures, and Load Reduction – Update 2022* report was prepared by the CCCWP to fulfill the requirement of MRP Provision C.11.a.iii.(3) and C.12.a.iii.(3) for updating the list of control measures reported annually as necessary to account for new control measures. This report is provided as Attachment 11.1.

Previous studies indicate that old industrial areas are the most likely land use type to contain high PCBs concentrations. CCCWP is continuing the source property identification process until all Old Industrial areas are screened and characterized for the likelihood of pollutant load removal and potential referral to the SFBRWQCB for further action. CCCWP compiled the past decade of source property investigation data to develop a Conceptual Work Plan for Completing PCB Source Area Investigations. In FY 2020/21, CCCWP continued to use its GIS platform for data management and analysis determining actual and potential load reductions, and as a tracking and reporting tool for Provisions C.11 and C.12 implementation work.

MRP Provision C.12.a. also requires the Permittees to implement sufficient control measures to achieve the PCBs 0.56 kg/yr PCB load reductions by June 30, 2020. This represents the Contra Costa County's estimated share of the regional 3 kg/yr PCB load reduction performance standard. The regional performance standard of 3 kg/yr was achieved in Fiscal Year 2019/20.

C.12.b - Assess PCBs Load Reductions from Stormwater

MRP Provisions C.11.b and C.12.b. require the Permittees to develop and implement an assessment methodology and data collection program to quantify mercury and PCBs loads reduced through implementation of pollution prevention, source control, and treatment control measures. Those requirements were fulfilled by the regional Interim Accounting Methodology for TMDL Loads Reduced report, approved by the Executive Officer in May 2017. These provisions also require the Permittees to submit, in 2018 and subsequent Annual Reports, refinements to the mercury and PCBs load reduction assessment methodology to assess load reductions in the next permit term. Those refinements are documented in the BASMAA Source Control Load Reduction Accounting for Reasonable Assurance Analysis Report, which was submitted with the Fiscal Year 2019/20 Annual Report. Comments were received from the Regional Water Board on the BASMAA Source Control Load Reduction Accounting for Reasonable Assurance Analysis report in April 2021. A revised report was approved by the Executive Officer in January 2022 and is included as Attachment 11.2.

In FY 2015/16, the CCCWP began development of a countywide GIS pilot project focused on maintaining, analyzing, interpreting, displaying, and reporting relevant municipal stormwater program data and information related to Provisions C.10 (i.e., trash load reduction activities) and C.11/C.12 (i.e., mercury and PCBs source property identification and abatement screening activities). In FY 2016/17, the CCCWP worked with the ACCWP and its GIS consultant PSOMAS to expand the countywide GIS platform and create the GIS C.3 Project Tracking and Load Reduction Accounting Tool to support additional compliance activities related to: 1) C.3.b Regulated Projects reporting; 2) the C.3.j Green Stormwater Infrastructure Planning and Implementation provisions; and 3) the C.11 Mercury Controls and C.12 PCBs Controls provisions. In FY 2021/22 the CCCWP continued to use its GIS consultant PSOMAS to improve the countywide GIS platform for C.3, C.10, and C.11/C/12 reporting. The data in the countywide platform was used to estimate the loads reduced that are reported in Attachment 11.1 (the WMA Report).

This GIS tool helps Contra Costa Permittees identify WMAs where multiple-benefit control measure implementation opportunities have been identified and prioritized for implementation during this permit term and over the coming decades. Additionally, this GIS database is being used to track and map existing C.3 projects, allow ease of ongoing review of opportunities for incorporating green stormwater infrastructure into existing and planned Capital Improvement Projects, and to report mercury and PCBs loads reduced.

<u>C.12.c - Plan and Implement GI to Reduce PCBs Loads</u>

C.12.c requires MRP Permittees to plan and implement green stormwater infrastructure sufficient to meet a performance criterion of 120 g per year PCBs reduced by green stormwater infrastructure for all MRP Permittees collectively. Contra Costa Permittees are tracking private C.3 projects and implementing early action public green stormwater infrastructure projects to achieve the PCBs load reductions specified by performance criteria. The regional performance standard of 120 g/yr by GI was achieved collectively by all MRP Permittees in Fiscal Year 2019/20. The TMDL Implementation Report provided in the Fiscal Year 2019/20 Annual Report includes a RAA of Permittee Green Infrastructure Plans that relates acres treated by green stormwater infrastructure to loads reduced over time.

<u>C.12.d - Prepare Implementation Plan and Schedule to Achieve TMDL Allocations</u>

MRP Provisions C.11.d and C.12.d require the Permittees to prepare a plan and schedule for mercury and PCBs control measure implementation and RAA demonstrating that sufficient control measures will be implemented to attain the mercury TMDL WLAs by

2028 and the PCBs TMDL WLAs by 2030. This requirement was fulfilled by the TMDL Implementation Report submitted with the Fiscal Year 2019/20 Annual Report.

<u>C.12.e - Evaluate PCBs Presence in Caulks/Sealants Used in Storm Drain or Roadway Infrastructure in Public Rights-of-Way</u>

The CCCWP participated in a BASMAA Regional Project to evaluate PCBs presence in caulks/sealants used in storm drains and roadway infrastructure, and to quantify the potential PCB load reduction benefits that may result from public infrastructure improvements. The final project report was submitted with the CCCWP's 2017/18 Annual Report.

<u>C.12.f - Manage PCB-Containing Material and Wastes During Building Demolition Activities so that PCBs do not Enter Municipal Storm Drains</u>

MRP Provision C.12.f. requires that Permittees develop and implement or cause to be developed and implemented an effective protocol for managing materials with PCBs concentrations of 50 parts per million or greater in applicable structures[17] at the time such structures undergo demolition, so that PCBs do not enter municipal storm drain systems. A Permittee is exempt from this requirement if it provided evidence acceptable to the Executive Officer in its FY 2016/17 Annual Report that the only buildings that existed pre-1980 within its jurisdiction were single-family residential and/or wood-frame buildings.[18]

Contra Costa Permittees located in Region 2 were required to develop a protocol by June 30, 2019 that includes each of the following components, at a minimum:

- The necessary authority to ensure that PCBs do not enter municipal storm drains from PCBs-containing materials in applicable structures at the time such structures undergo demolition
- A method for identifying applicable structures prior to their demolition

[17] Applicable structures are buildings built or remodeled from January 1, 1950 through December 31, 1980, with the following exemptions: single-family residential buildings, wood-framed buildings, and partial building demolitions.

[18] The City of Clayton provided acceptable evidence and is exempt from this provision.

- Method(s) for ensuring PCBs are not discharged to the municipal storm drain from demolition of applicable structures

By July 1, 2019 and thereafter, Permittees are required to:

- Implement or cause to be implemented the PCBs management protocol for ensuring PCBs are not discharged to municipal storm drains from demolition of applicable structures via vehicle track-out, airborne releases, soil erosion, or stormwater runoff; and,
- Develop an assessment methodology and data collection program to quantify in a technically sound manner PCBs loads reduced through implementation of the protocol for controlling PCBs during demolition of applicable structures.

BASMAA completed a regional project in March 2019 that assisted developing local programs to manage PCBs-containing materials during building demolition. The assistance included model ordinance language, guidance materials, tools and training materials and conducted outreach. Contra Costa Permittees began implementing the program on July 1, 2019. Building demolition data were gathered from Permittees with applicable structures and are included in the PCBS in Building Materials Management Program – Fiscal Year 2021/22 Data Summary (Attachment 12.1).

<u>C.12.g - Fate and Transport Study of PCBs: Urban Runoff Impact on San Francisco Bay Margins</u>

MRP Provision C.12.g requires Permittees to conduct or cause to be conducted studies concerning the fate, transport, and biological uptake of PCBs discharged from urban runoff to San Francisco Bay margin areas. Provision C.12.g is being addressed through a multi-year project by the San Francisco Bay RMP to develop a series of conceptual models of PCBs in Priority Margin Units (PMU). The project is:

- Identifying margin units that are high priority for management and monitoring.
- Developing conceptual models and mass budgets for margin units downstream of watersheds where management actions will occur; and,
- Conducting monitoring in these units as a performance measure.

Four urban embayments along the Bay shoreline with management actions planned or ongoing to address PCBs in the upstream watersheds were initially selected as PMU for conceptual modeling:

- Emeryville Crescent (Alameda County)
- San Leandro Bay (Alameda County)
- Steinberger Slough (San Mateo County)
- Richmond Harbor (Contra Costa County)

The conceptual models are intended to provide a foundation for future monitoring to track responses to load reductions and may eventually help guide planning of management actions. The Richmond Harbor in Contra Costa County has not to date had any resources allocated for conceptual model development.

BASMAA representatives to the RMP will participate in the RMP PCBs Workgroup to help provide ongoing oversight of PMU conceptual model development and the related RMP Special Studies. CCCWP will communicate with the RMP PCBs Workgroup to encourage development of a conceptual model for the Richmond Harbor PMU.

C.12.h - Implement a Risk Reduction Program

The Contra Costa Permittees implement risk reduction activities to increase awareness of the risks of mercury and PCBs contamination when consuming fish caught in the San Francisco Bay/Delta:

- Kiosks and Pier Postings **–** The CCCWP works with the East Bay Regional Parks District to post, inspect, and maintain fish consumption warning signs at fishing piers and harbor/marina kiosks around CCC. CCCWP funds the replacement of signs which is necessary when signs are vandalized or when fish consumption information is updated.
- Point-of-purchase outreach at fishing supply stores – In FY 2021/22, the CCCWP continued to work with marinas and local fishing supply stores throughout the county to make fish consumption warning information available to the public through displaying multi-lingual signage and brochures.

- A report on risk reduction activities is provided in Attachment 12.2.

SECTION 13 – PROVISION C.13 COPPER CONTROLS

Introduction

Under MRP 2.0, Contra Costa Permittees need to report on efforts to control copper discharges from architectural copper; from pools, spas, and fountains that contain copper-based compounds; and from industrial sources. A review of these efforts specific to the CCCWP is provided here. Copper control activities conducted at the local level are reported in the Individual Municipal Annual Reports.

Accomplishments

C.13.a - Architectural Copper

In FY 2015/16, CCCWP finalized and approved a public outreach flyer entitled *Requirements for Copper Roofs and Other Architectural Copper.* Contra Costa Permittees continue to make this flyer available to the public at permit counters. CCCWP also encourages Permittees to include the flyer with applicable building permits and to incorporate the BMPs as conditions of approval for any discretionary projects with architectural copper features.

C.13.b - Pools, Spas and Fountains

Since many of the larger community pools within CCC are included in the inventory of facilities that have the potential to have non-stormwater discharges, these facilities are inspected on a regular basis as required by Provision C.4. During the inspection process, stormwater inspectors convey the requirements for managing discharges from pools relative to stormwater and wastewater regulations. For this reason, CCCWP has not had to devote significant additional resources to address this potential source of copper.

On occasion, as part of the 1-800-No-Dumping Line or other complaint hotlines, municipal staff or their contracted stormwater inspectors have had to counsel residential owners of pools to instruct them on the proper procedure for discharging their pool water or cleaning of their filters. CCCWP has made available to municipal staff and their contracted inspectors a *Draining Pools and Spas* brochure to provide guidance to homeowners on managing their pool discharges.

C.13.c - Industrial Sources

The CCCWP has provided training to stormwater inspectors on industrial sources of copper. This training has been included in past annual C.4 commercial and industrial stormwater inspection workshops. As inspectors have been well-trained in this area, CCCWP has not had to devote significant resources to address these particular sources.

FY 2022/23 Planned Activities

CCCWP will continue to assist Permittees with meeting Copper Control requirements, and evaluating appropriate requirements for MRP 3.0. CCCWP will be working with Permittees to ensure they have established a robust procedure within their municipalities' planning and building departments to adequately address new potential sources of copper from architectural features and management of pools, spas, and fountains.

CCCWP is considering providing outreach to homeowners who have personal pools. For this task, CCCWP would work with Permittees to inventory residential pools and once inventoried, send outreach material to the pools owners to ensure they understand maintenance, filter cleaning, and draining requirements relative to stormwater regulations.

CCCWP will continue to work with stormwater inspectors to address industrial sources of copper identified during inspections and ensure that proper BMPs are in place at such facilities to minimize discharge of copper to storm drains. It is anticipated that the FY 2022/23 stormwater inspector training required under Provision C.4 may include a refresher on how to identify POC including Copper and Mercury at industrial facilities and BMPS for controlling these pollutants and preventing their discharge to stormwater.

SECTION 14 – PROVISION C.15 EXEMPTED AND CONDITIONALLY EXEMPTED DISCHARGES

Introduction

As outlined in Section 2, the CCCWP's MOC is tasked with the review, development and coordination of any countywide and/or regional tasks conducted to assist Contra Costa Permittees with implementation of the mandates in Provision C.15. CCCWP resources on this provision continue to be minimal. One of the primary reasons for limited focus on this provision is that Contra Costa Permittees that are also water purveyors and used to report on their planned and unplanned drinking water discharges in their MRP Annual Reports are now reporting these discharges under their Statewide NPDES Permit for Drinking Water System Discharges (Order WQ 2014-0194-DWQ).

FY 2022/23 Planned Activities

In FY 2022/23, it is anticipated that Group Program activities related to Provision C.15 will continue to be minimal. CCCWP staff may work with Permittees to improve outreach to address potable water discharges to the MS4s arising from large-scale landscape irrigation projects. This outreach may include working more closely with Contra Costa Water District and East Bay Municipal Utility District. Other issues under this provision will be addressed as needed.

SECTION 15 – PROVISION C.16.5 PROVISIONS APPLICABLE TO EAST COUNTY PERMITTEES

Introduction

Provision C.16.5 was added to the MRP in January 2019 to include the Cities of Brentwood, Antioch and Oakley, and portions of Unincorporated County and the Flood Control District located in Water Quality Control Board Region 5 (East County Permittees), as dischargers named in the San Francisco Bay MRP. The provisions align the activities of East County Permittees with Permittees located in Region 2 and describes actions by East County Permittees necessary to implement TMDLs applicable in Region 5.

C.16.5.a - Green Infrastructure Planning and Implementation

This provision requires Development and Implementation of GI Plans. East County Permittees were required to have a GI framework approved by their governing bodies by December 31, 2019. Completed GI plans, including documentation of legal mechanisms for implementation, were due by December 31, 2020. East County Permittees self-certify these completion deadlines.

C.16.5.b - Inspections for Construction Site Control at Hillside Projects

This provision requires Inspections for construction site control on hillslope properties. East County Permittees were required to self-certify in their 2021 annual report the criteria used to determine hillslope development, including any maps or other written criteria.

C.16.5.c - Trash Load Reductions

This provision requires trash control plans. In FY 2020/21, East County Permittees were required to (i) map the location or otherwise record the location, and (ii) provide the trash control status of lands greater than 10,000 ft^2 that they do not own or operate, but that are plumbed directly to their storm drain systems in Very High, High, and Moderate trash generation areas. This information is retained by the East County Permittees for inspection upon request.

C.16.5.d - Mercury Controls

This provision exempts East County Permittees from Provision C.11 (Mercury controls to implement the San Francisco Bay Mercury TMDL).

C.16.5.e - Polychlorinated Biphenyls Controls

This provision exempts East County Permittees from Provision C.12 (PCB controls to implement the San Francisco Bay PCBs TMDL).

C.16.5.f - Diazinon and Chlorpyrifos Controls

This provision requires East County Permittees to maintain WLAs for diazinon and chlorpyrifos. Practically, this means demonstrating the diazinon and chlorpyrifos water quality standards are not exceeded. In 2018, CCCWP transmitted a letter to the CVRWQCB providing monitoring data that documented exceedances of numeric water quality objectives for diazinon and chlorpyrifos have generally ceased since 2009. CCCWP has ceased directly monitoring diazinon and chlorpyrifos because these products are no longer in general commercial use. CCCWP verifies that WLAs are maintained via toxicity screening using *Cerodaphnia dubia*, a species of water flea known to be sensitive to diazinon and chlorpyrifos.

C.16.5.g - Methylmercury Monitoring

This provision requires methylmercury monitoring with a minimum frequency of eight samples per year. Results are reported in the annual Urban Creeks Monitoring Report.

C.16.5.h - Delta Mercury Control Program

This provision requires actions to implement a Delta Methylmercury Control Program. The Methylmercury Control Program implements WLAs for methylmercury assigned to subareas of the Delta that receive stormwater discharges from East County Permittees. The West Delta Sub Area (receiving waters of East and West Antioch Creeks) is in attainment of it WLA of 3.2 grams per year. The Marsh Creek subarea appears to exceed its WLA of 0.3 grams per year. The CCCWP's Methylmercury Control Study Report provided evidence that attainment of the WLA for the Marsh Creek sub-area is technologically infeasible. In WY 2019/20, CCCWP responded to CVRWQCB questions about the Methylmercury Control Study and revised the final study report in response to clarifications requested by the CVRWQCB. In June 2020, CCCWP submitted a Report of Waste Discharge that recommended specific permit language to implement the methylmercury TMDL. CCCWP conducted reasonable potential analyses and submitted preliminary results to the CVRWQCB in March 2022. CCCWP anticipates working with the CVRWQCB staff to review the Delta Methylmercury TMDL and revise the WLAs and attainment schedule to reflect the results of the CCCWP Methylmercury Control Study and RAA results.

Provision C.16.5.h includes specific control measures required by East County Permittees to implement the Delta Methylmercury Control Plan:

1) **Mercury collection and recycling.** Mercury Collection and Recycling. During FY 2021/22, the CCCWP continued to coordinate with Contra Costa Permittees and local household hazardous waste (HHW) collection facilities to implement mercury collection and recycling in accordance with MRP 2.0 Provision C.16.5.h.(1). These efforts are only required to be reported for the East County Permittees. Delta Diablo serves East County Permittees. Contra Costa Permittees collect HHW at three regional facilities in the County:
    - Central Contra Costa Sanitary District
    - Delta Diablo
    - West County Wastewater District

    In addition to the above mercury collection activities, many municipally owned and maintained non-decorative streetlights in CCC have been and continue to be converted from mercury and/or high-pressure sodium vapor streetlights to Light Emitting Diode streetlights. Contra Costa County's Landscaping and Lighting District has coordinated with PG&E to replace mercury-containing light fixtures with LED fixtures. As a result, Contra Costa County has converted all of its mercury and/or high-pressure sodium vapor street lights to Light Emitting Diode (LED) street lights. In addition, the County Public Works Department had also converted all fluorescent bulbs in the main office building to LED. The old fixtures included the high-pressure sodium vapor lamps (bulbs) at various wattage sizes. Each streetlamp is reported to have from 1 to 22 mg of mercury, with an average of 16 mg/bulb for a 100-Watt bulb. This streetlight replacement removing substantial amounts of mercury from the environment.

2) **Enhanced Municipal Management Practices to Reduce Sediment Discharges.** East County Permittees are required to list in their annual reports the municipal maintenance activities used to minimize sediment discharged from urban stormwater.
3) **Public education and risk reduction.** East County Permittees are required to conduct ongoing public education about mercury pollution prevention and health guidance for reducing mercury risk from fish consumption. East County Permittees provide pollution prevention outreach through implementation of Provision C.7. Please see Section 12 describing the Fish Risk Reduction Program for Mercury and PCBs: 2022 Status Report that fulfills this requirement for East County Permittees.

Contra Costa Clean Water Program

Annual Report Attachments

Attachment 1.1

Contra Costa Clean Water Program
Staffing and Consultants/Contractors

Contra Costa Clean Water Program (CCCWP) Management Structure

Attachment 1.1

CCCWP Management Committee

Courtney Riddle
Program Manager [1]

Karin Graves
Senior
Watershed Management
Planning Specialist

1) Vacant
2) Vacant

Watershed Management
Planning Specialists [2]

Administrative Support Staff

Andrea Bullock
Administrative
Services Assistant
III

Michael Burger
Clerk- Senior
(full-time)

Consultants / Contractors

C.3
Dan Cloak Environmental Consulting
Dubin Environmental Consulting
Haley and Aldrich

C.4
Central Contra Costa Sanitary District
Delta Diablo Sanitation District
East Bay Municipal Utility District

C.7
Kathy Kramer Consulting
Matt Bolender-Used Oil Program
Sagent Marketing

C.8, C.10, C.11, C.12
Watershed Resources Consulting
Wood Environment and Infrastructure Solutions
Kinnetic Environmental[3]
Larry Walker & Associates
Geosyntec
PSOMAS
EOA. Inc.

C.9
Debi Tidd Consulting
Websight Design
Plant Harmony

1. The Program Manager has been on extended leave since August 26, 2019. Karin Graves became the acting Program manager in January 2021.
2. For most of FY 21-22 the two Watershed Management Planning Specialist (WMPS) positions were staffed by consultants. Lisa Welsh and Elizabeth Yin acted as staff augmentation to these two positions. In June 2022 the CCCWP was able to permanently fill one of the WMPS positions.
3. ADH Environmental changed their name to Kinnetic Environmental in October, 2021.

G://GrpData/NPDES/Org Charts/FY 21-22/CCCWP Program Management 21-22
Last Updated: August 3, 2022

Attachment 1.2

Contra Costa Clean Water Program
Organizational Structure

CONTRA COSTA CLEAN WATER PROGRAM
ORGANIZATIONAL STRUCTURE

Attachment 1.2

Participants -- Antioch, Brentwood, Clayton, Concord, Danville, El Cerrito, Hercules, Lafayette, Martinez, Moraga, Oakley, Orinda, Pinole, Pittsburg, Pleasant Hill, Richmond, San Pablo, San Ramon, Walnut Creek, Contra Costa County, and Contra Costa County Flood Control & Water Conservation District

ADMINISTRATIVE COMMITTEE[2]

DUTIES
- Administration
- Strategic Planning
- Personnel
- Budget
- Conflict Resolution

MANAGEMENT COMMITTEE

DUTIES
- Decision Making Body
- Strategic Planning
- Sets Policies / Directives
- Program Manager Evaluation
- Approves / Appropriates Budget

STAFF

Courtney Riddle, Program Manager[1]
Karin Graves, Senior Watershed Management Planning
Mitch Avalon, Program Consultant
Lisa Welsh, Program Consultant
Liz Yin, Program Consultant
Dan Cloak, Program Consultant
Alina Constantinescu, Program Consultant
Andrea Bullock, Administrative Analyst
Michael Burger, Clerk – Senior Level

MONITORING COMMITTEE[2]

DUTIES
- C.8 - Water Quality Monitoring
- C.9 - Pesticides Toxicity Control
- C.11 - Mercury Controls
- C.12 - Polychlorinated Biphenols (PCBs) Controls
- C.13 - Copper Controls
- C.16.5 – East County Coordination

DEVELOPMENT COMMITTEE[2]

DUTIES
- C.3 - New Development and Redevelopment
- C.3 – Green Infrastructure
- C.6 - Construction Site Control

PUBLIC INFORMATION / PARTICIPATION COMMITTEE[2]

DUTIES
- C.7 - Public Information and Outreach
- C.9 Pesticides Toxicity Control

MUNICIPAL OPERATIONS COMMITTEE[2]

DUTIES
- C.2 - Municipal Operations
- C.4 - Industrial and Commercial Site Controls
- C.5 - Illicit Discharge Detention and Elimination
- C.9 - Pesticides Toxicity Control
- C.10 - Trash Load Reduction
- C.15 - Exempted and Conditionally Exempted Discharges

BAMSC MONITORING / POC COMMITTEE

- Michele Mancuso (CCC)
- Amanda Booth (San Pablo)
- Lucile Paquette (Walnut Creek)
- Lisa Welsh (CCCWP Consultant)

BAMSC DEVELOPMENT COMMITTEE

- John Steere (CCC)
- Lucile Paquette (Walnut Creek)
- Phil Hoffmeister (Antioch)

BAMSC PUBLIC INFORMATION / PARTICIPATION COMMITTEE

- Karin Graves (CCCWP)
- Hilary Pierce (CCCWP)

BAMSC TRASH COMMITTEE

- Beth Baldwin (CCC)

BAMSC Steering Committee

- Karin Graves (CCCWP)

(1) Courtney Riddle has been on leave since August 2019
(2) The Administrative, Monitoring, Development, PIP, and Municipal Ops Committees are advisory to the Management Committee.

G:\NPDES\Org Charts\Program Organization Charts\FY 21-22\CCCWP Org Structure 21-22_09.14.2022.vsd

Updated: September 14, 2022

Attachment 1.3

Contra Costa Clean Water Program

BAMSC and SFBRWQCB Committee Participation

CONTRA COSTA CLEAN WATER PROGRAM
MRP 3.0 BAMSC AND SFBRWQCB COMMITTEE PARTICIPATION

Attachment 1.3

Participants -- Antioch, Brentwood, Clayton, Concord, Danville, El Cerrito, Hercules, Lafayette, Martinez, Moraga, Oakley, Orinda, Pinole, Pittsburg, Pleasant Hill, Richmond, San Pablo, San Ramon, Walnut Creek, Contra Costa County, and Contra Costa County Flood Control & Water Conservation District

MRP 3.0 STEERING COMMITTEE

- Phil Hoffmeister (Antioch)
- Michele Mancuso (CCC)
- Frank Kenendy (Pleasant Hill)
- Amanda Booth (San Pablo)
- Robin Bartlett (San Ramon)
- Lucile Paquette (Walnut Creek)
- Mitch Avalon (CCCWP)
- Karin Graves (CCCWP)
- Dan Cloak (CCCWP)

HOMELESSNESS WORK GROUP

- Amanda Booth (San Pablo)
- Michele Mancuso (County)
- Jose Avila (Contra Costa County Health)
- Mitch Avalon (CCCWP)

REPORTING AND TRACKING WORK GROUP

- Mitch Avalon (CCCWP)

FIREFIGHTING WORK GROUP

- Eric Govan (Richmond Fire Department)
- Dan McClellan (Contra Costa County Fire Protection District)
- Amanda Booth (San Pablo)
- Karin Graves (CCCWP)

MRP 3.0 C.3 WORKGROUP

- John Steere (CCC)
- Frank Kennedy (Pinole)
- Amanda Booth (San Pablo)
- Dan Cloak (CCCWP)
- Karin Graves (CCCWP)
- Lisa Austin (CCCWP)

MRP 3.0 C.8 WORKGROUP

- Lucile Paquette (Walnut Creek)
- Lisa Welsh (CCCWP)

MRP 3.0 C.10 WORKGROUP

- Elizabeth Yin (CCCWP)
- Michele Mancuso (CCC)
- Amanda Booth (San Pablo)

MRP 3.0 C.11/C.12 WORKGROUP

- Michele Mancuso (CCC)
- Amanda Booth (San Pablo)
- Lucile Paquette (Walnut Creek)
- Lisa Welsh (CCCWP)
- Karin Graves (CCCWP)

Attachment 1.4

Contra Costa Clean Water Program

Management Committee and Subcommittee Participation & Attendance

Management Committee FY 2021-22

MUNICIPALITY	REPRESENTATIVE	JUL	AUG	SEP	OCT	NOV (Special)	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	INDIV% ATT	MUNI % ATT
City of Antioch	**Phil Hoffmeister[1]**	*	*	*	*	*	*		*	*	*	*	*	*	92%	**92%**
City of Brentwood	Nouae Vue														0%	**62%**
	Meghan Oliveira[2]		*	*	*			*	*	*		*	*		62%	
	Allen Baquilar														0%	
City of Clayton	Laura Hoffmeister				*		*		*	*	*		*		46%	**54%**
	Reina Schwartz													*	8%	
City of Concord	Kevin Marstall														0%	**100%**
	Bruce Davis	*	*	*	*	*	*	*	*	*	*	*	*	*	100%	
Contra Costa County	Brian Balbas														0%	**100%**
	Allison Knapp		*	*	*	*	*					*		*	54%	
	Tim Jensen		*	*									*		23%	
	Michele Mancuso	*			*	*	*	*	*	*	*	*	*	*	85%	
CCC Flood Control	Tim Jensen	*	*	*	*	*		*	*			*	*	*	77%	**100%**
	Michele Mancuso						*			*	*				23%	
	Allison Knapp														0%	
	Michelle Cordis								*						8%	
Town of Danville	Bob Russell	*	*	*	*	*	*	*	*	*	*	*	*	*	100%	**100%**
	Steven Jones														0%	
	Mark Rusch														0%	
City of El Cerrito	Stephen Prée	*	*	*	*	*	*	*	*	*	*	*	*		92%	**100%**
	Will Provost														0%	
	Christina Leard											*	*	*	23%	
	Yvetteh Ortiz															
City of Hercules	Mike Roberts														0%	**100%**
	Jose Pacheco														0%	
	Jeff Brown														0%	
	Nai Saelee	*	*	*	*	*	*	*	*	*	*	*	*	*	100%	
	Frank Kennedy															
City of Lafayette	Matt Luttropp		*	*	*	*			*		*	*			54%	**85%**
	Tim Clark	*								*			*	*	31%	
City of Martinez	Khalil Yowakim	*	*		*	*	*	*	*	*		*			69%	**85%**
	Frank Kennedy											*	*	*	23%	
Town of Moraga	Shawn Knapp														0%	**100%**

	Frank Kennedy	*	*	*	*	*		*	*	*	*	*	*	*	92%	
	AJ Kennedy						*								8%	
City of Oakley	Billilee Saengchalern														0%	**100%**
	Frank Kennedy	*	*	*	*	*		*	*	*	*	*	*	*	92%	
	Andrew Kennedy				*		*								15%	
City of Orinda	Scott Christie	*	*	*	*	*	*	*	*	*	*	*			85%	**100%**
	Frank Kennedy												*	*	15%	
	Kevin McCourt					*									8%	
City of Pinole	Misha Kaur	*	*	*	*	*	*	*	*		*	*	*		85%	**85%**
City of Pittsburg	Jolan Longway	*	*	*		*	*	*	*		*	*	*	*	85%	**92%**
	Richard Abono	*													8%	
	Joe Camaddo				*										8%	
City of Pleasant Hill	Philip Ho											*			8%	**100%**
	Frank Kennedy	*	*	*	*	*		*	*	*	*	*	*	*	92%	
	AJ Kennedy						*									
City of Richmond	Joe Leach		*	*	*	*	*						*		46%	**54%**
	Mary Phelps													*	8%	
City of San Pablo	Amanda Booth	*							*	*	*	*	*	*	54%	**100%**
	Karineh Samkian	*	*	*	*	*	*	*							54%	
	Sarah Kolarik														0%	
	Jill Mercurio														0%	
City of San Ramon	Kerry Parker	*	*	*		*	*	*	*	*	*	*	*	*	92%	**100%**
	Robin Bartlett	*			*	*									23%	
	Maria Fierner														0%	
City of Walnut Creek	Lucile Paquette	*	*	*	*	*	*	*	*	*	*	*	*	*	100%	**100%**
	Neil Mock														0%	
	Steve Waymire														0%	
Guests																
PROGRAM STAFF																
Courtney Riddle																
Andrea Bullock		*	*	*	*	*	*	*	*	*	*	*	*	*		
Karin Graves		*	*	*	*	*	*	*	*	*	*	*	*	*		
Clerk		*	*	*	*	*	*	*	*	*		*	*	*		
Mitch Avalon	Consultant	*	*	*	*	*	*	*	*	*		*				
Elizabeth Yin	Consultant	*	*	*	*	*	*	*	*	*	*	*	*	*		

Dan Cloak	Consultant	*		*	*	*		*	*	*		*	*	*		
Alina Constantinescu	Consultant			*	*	*		*	*			*	*	*		
Lisa Welsh	Consultant	*	*		*	*	*	*		*	*	*	*	*		
Sandy Matthews	Consultant	*			*	*			*	*	*	*				
Lisa Austin	Consultant			*	*	*		*								
Hilary Pierce										*	*	*				
Yvana Hrovat												*	*	*		

(1) Chairperson (2) Vice- Chairperson (3)Meeting Cancelled

ADMINISTRATIVE COMMITTEE FY 21-22 ATTENDANCE ROSTER

MUNICIPALITY	REPRESENTATIVE	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	INDIV % ATT	MUNI % ATT
City of Antioch	**Phil Hoffmeister**[(1)]		*	*	*	*	*	*	*	*	*	*	*	92%	**92%**
City of Brentwood	**Meghan Oliveira**[(2)]	*	*	*		*	*	*	*	*	*	*		83%	**83%**
	Allen Baquilar	*												8%	
Town of Danville	Bob Russell	*	*	*		*	*		*		*	*	*	75%	**83%**
	Mark Rusch				*									8%	
Contra Costa County	Michele Mancuso	*	*	*		*	*	*	*	*	*	*	*	92%	**100%**
	Tim Jensen				*									8%	
CCC Flood Control	Tim Jensen	*	*	*	*		*	*	*	*	*	*	*	92%	**100%**
	Michele Mancuso					*								8%	
City of Hercules	Jeff Brown	*	*	*	*	*	*		*	*	*		*	83%	**83%**
	Nai Saelee													0%	
City of Pleasant Hill	Ananthan Kanagasundaram													0%	**67%**
	Frank Kennedy	*	*				*	*	*		*	*	*	67%	
City of Oakley	Bilillee Saengchalern													0%	**17%**
	Frank Kennedy	*	*											17%	
NON-VOTING															
City of Walnut Creek	Lucile Paquette	*	*	*	*		*	*	*	*	*	*	*		
PROGRAM STAFF															
	Courtney Riddle														
	Andrea Bullock		*	*	*	*	*	*	*	*	*	*	*		
	Karin Graves	*	*	*	*	*	*	*	*	*	*	*	*		
	Clerk	*	*	*	*	*	*	*	*	*	*	*	*		
GUESTS															

City of San Pablo	Amanda Booth	*						*	*	*	*	*	*		
City of Concord	Bruce Davis		*												
Contra Costa County	Allison Knapp			*	*	*			*				*		
City of Clayton	Laura Hoffmeister					*		*			*				
City of Pittsburg	Jolan Longway												*		
CONSULTANTS															
	Dan Cloak														
	Mitch Avalon	*		*	*	*	*	*	*	*	*	*	*		
	Liz Yin		*												
	Lisa Austin														
	Lisa Welsh														

(1) Chairperson (2) Vice-Chairperson (3) Meeting cancelled

PUBLIC INFORMATION/PARTICIPATION COMMITTEE FY 21-22

MUNICIPALITY	REPRESENTATIVE	JUL	AUG	SEP	OCT[3]	NOV	DEC	JAN	FEB	MAR[3]	APR	MAY	JUN	INDIV % ATT	MUNI % ATT
City of Antioch	Julie Haas-Wajdowicz	*	*			*		*	*		*	*	*	73%	**90%**
	Phil Hoffmeister			*										9%	
CCC Flood Control	**Melinda Harris**[1]			*		*		*	*		*			50%	**80%**
	John Steere													0%	
	Michele Mancuso						*					*	*	30%	
City of Orinda	Kevin McCourt	*	*				*	*			*	*	*	70%	**80%**
	Scott Christie			*										10%	
City of San Ramon	**Kerry Parker**[2]	*	*	*		*	*	*	*		*		*	90%	**90%**
	Shane Hsieh													0%	
AC acting a PIP Members	**REPRESENTATIVE**														
City of Brentwood	Meghan Oliveira	*		*		*	*	*			*			60%	**60%**
	Allen Baquilar	*												10%	
Town of Danville	Bob Russell		*	*		*	*		*		*	*	*	80%	**90%**
	Mark Rusch													0%	
	Nicola Shihab							*						10%	
Contra Costa County	Michele Mancuso		*			*	*	*	*		*	*	*	80%	**90%**
	Tim Jensen													0%	
	Beth Baldwin			*										10%	
	Michelle Giolli			*										10%	
City of Hercules	Jeff Brown		*											10%	**10%**
	Nai Saelee													0%	
City of Pleasant Hill	Ananthan Kanagasundarm													0%	**80%**
	Frank Kennedy	*	*				*	*	*		*	*	*	80%	
City of Oakley	Billilee Saengchalern													0%	**100%**
	Frank Kennedy	*												100%	
Guests															
City of San Pablo	Amanda Booth							*	*		*		*		
City of Walnut Creek	Lucile Paquette										*		*		

PROGRAM STAFF															
Courtney Riddle															
Andrea Bullock			*	*		*	*	*	*		*	*	*		
Allison Knapp															
Karin Graves		*	*	*		*	*	*	*		*	*			
Clerk		*	*	*		*	*	*	*		*		*		
Hilary Pierce	Consultant		*	*		*	*	*	*		*	*	*		
Emily Rogers	Consultant	*	*	*		*	*	*	*						
Sandy Matthews	Consultant	*	*	*											
Anna Minard	Consultant	*	*	*		*	*	*	*				*		
Finnisha Eastman				*		*	*	*	*				*		
Mitch Avalon	Consultant	*		*		*	*	*	*		*	*	*		

(1) Chairperson, (2) Vice-Chairperson, (3) Meeting Cancelled

DEVELOPMENT COMMITTEE FY 21-22

MUNICIPALITY	REPRESENTATIVE	JUL	AUG	SEP	OCT	NOV [3]	DEC	JAN	FEB	MAR	APR	MAY	JUN	INDIV % ATT	MUNI % ATT
City of Antioch	Phil Hoffmeister				*				*	*	*	*	*	75%	**75%**
														0%	
City of Brentwood	Aman Grewal	*	*	*			*	*	*	*	*	*	*	91%	**91%**
	Allen Baquilar													0%	
City of Clayton	Laura Hoffmeister				*						*			18%	**27%**
	Larry Theis												*	9%	
City of Concord	Mitra Abkenari	*	*	*	*			*	*		*	*	*	82%	**82%**
	Bruce Davis													0%	
Contra Costa County	**John Steere**[2]	*	*		*		*	*	*	*	*		*	82%	**100%**
	Michele Mancuso			*					*	*				27%	
	Michelle Giolli			*								*		18%	
Town of Danville	Bob Russell			*	*		*	*	*	*	*	*	*	82%	**82%**
	Mark Rusch													0%	
City of Lafayette	Matt Luttropp			*			*	*	*	*	*	*	*	73%	**73%**
	Tim Clark										*			9%	
Town of Moraga	Mark Summers													0%	**91%**
	Frank Kennedy	*	*	*	*		*	*		*	*	*	*	91%	
City of Pittsburg	**Joseph Camaddo**[1]	*	*	*	*		*		*	*	*		*	82%	**91%**
	Jolan Longway											*		9%	
City of Pleasant Hill	Ananthan Kanagasundarm													0%	**91%**
	Frank Kennedy	*	*	*	*		*	*		*	*	*	*	91%	
City of San Ramon	Rod Wui			*			*	*	*	*	*	*	*	73%	**73%**
	Theresa Peterson													0%	
City of Walnut Creek	Joel Camacho	*	*	*	*		*	*	*	*	*	*	*	100%	**100%**

	Lucile Paquette	*	*	*					*	*	*	*	*	73%	
GUESTS															
City of San Pablo	Amanda Booth	*	*					*	*	*	*	*			
City of Hercules	John Brown												*		
PROGRAM STAFF															
Karin Graves		*	*	*	*		*	*	*						
Erin Lennon													*		
Dan Cloak (consultant)		*	*	*	*		*	*	*	*	*	*	*		
Lisa Austin (consultant)															
Mitch Avalon (consultant)		*	*	*	*		*	*	*	*	*	*	*		
Alina Constantinescu							*	*	*	*	*	*	*		
Yvana Hrovat									*	*	*	*	*		

(1) Chairperson, (2) Vice-Chairperson, (3) Meeting Cancelled

MONITORING COMMITTEE FY 21-22

MUNICIPALITY	REPRESENTATIVE	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	INDIV % ATT	MUNI % ATT
City of Antioch	Phil Hoffmeister	*	*					*					*	33%	**33%**
CCC Flood Control	**Beth Baldwin**[(2)]	*	*	*	*	*	*	*	*	*	*	*	*	100%	**100%**
	Michelle Giolli	*		*	*	*	*				*	*		58%	
	Michele Mancuso	*	*		*									25%	
City of Pinole	Misha Kaur	*	*	*	*	*	*	*	*	*	*	*	*	100%	**100%**
	Andrew Kennedy													0%	
City of Pittsburg	**Joseph Camaddo**[(1)]	*	*		*	*	*	*	*	*		*	*	83%	**100%**
	Jolan Longway			*							*			17%	
City of Richmond	Marcella Navas	*												8%	**83%**
	Terri Mason			*	*	*	*	*		*	*	*	*	75%	
City of Walnut Creek	Lucile Paquette	*		*	*	*	*	*	*	*	*	*	*	92%	**92%**
	Neil Mock													0%	
	Mojgan Rahimi													0%	
PROGRAM STAFF/CONSULTANTS															
Courtney Riddle															
Karin Graves			*	*		*	*	*	*	*		*			
Clerk															
Andrea Bullock		*													
GUESTS															
San Pablo	Amanda Booth		*						*		*	*	*		
ADH	Christian Kocher			*											
City of Lafayette	Francine Kuykendall												*		
Consultants															
Dan Cloak															
Lisa Austin		*	*	*	*	*	*	*	*	*	*	*	*		
Mitch Avalon		*	*			*	*	*	*		*	*	*		
Lisa Welsh		*		*	*	*	*	*	*	*	*	*	*		
Brian Laurenson													*		

MUNICIPAL OPERATIONS COMMITTEE FY 21-22

MUNICIPALITY	REPRESENTATIVE	JUL	AUG	SEP	OCT	NOV	DEC[3]	JAN	FEB	MAR[3]	APR	MAY	JUN	INDIV % ATT	MUNI % ATT
City of Antioch	Phil Hoffmeister	*	*	*	*	*			*		*	*		80%	**100%**
	Jeff Cook				*	*		*	*		*	*	*	70%	
City of Brentwood	Melissa Barcelona	*	*	*	*	*		*	*			*		80%	**80%**
	Meghan Laporta													0%	
City of Concord	Jesse Crawford	*	*	*	*	*		*				*		70%	**70%**
	William Gallagher													0%	
Contra Costa County	**Michelle Giolli**[2]	*	*	*	*	*		*			*	*	*	90%	**100%**
	Beth Baldwin		*	*	*	*		*	*		*	*	*	90%	
	Michele Mancuso	*						*	*				*	40%	
Town of Danville	Bob Russell				*	*					*	*	*	50%	**50%**
	Mark Rusch													0%	
City of El Cerrito	Stephen Prée	*	*	*	*	*		*	*		*	*	*	100%	**100%**
	Will Provost	*												10%	
City of Martinez	Khalil Yowakim													0%	**0%**
														0%	
City of Pittsburg	**Joseph Camaddo**[1]	*	*	*	*	*		*	*		*	*	*	100%	**100%**
	Jolan Longway					*							*	20%	
City of Richmond	Marcella Navas	*	*											20%	**50%**
	Terri Mason					*						*	*	30%	
City of San Pablo	Amanda Booth	*							*		*	*		40%	**90%**
	Karineh Samkian		*	*	*	*		*						50%	
City of Walnut Creek	Lucile Paquette	*	*	*	*	*		*	*		*	*	*	100%	**100%**

Non-Voting Members															
PROGRAM STAFF															
Courtney Riddle															
Andrea Bullock															
Karin Graves			*	*				*	*		*	*			
Mitch Avalon		*			*	*		*	*				*		
Kristine Cornellie		*													
Liz Yin		*	*	*	*	*		*	*		*	*	*		
Lisa Welsh									*						
Lisa Austin									*						
Erin Lennon													*		

(1) Chairperson, (2) Vice-Chairperson, (3) Meeting Cancelled

Attachment 7.1

Bringing Back the Natives Garden Tour 2022
Final Report

Bringing Back the Natives Garden Tour
1718 Hillcrest Road
San Pablo CA 94806
(510) 236-9558
mailto:Kathy@KathyKramerConsulting.net
http://www.BringingBackTheNatives.net

Executive Summary

2022 online and in-person Bringing Back the Natives Garden Tour

Overall

- 3,036 people registered for this year's Tour.
- 40% of respondents participated in both the online and in-person tours.
- There have been more than 100,000 views of the Tour's YouTube channel in the last 2.5 years.
- The YouTube channel has nearly 2,000 subscribers.

Online Tour

- The online Tour took place on Saturday and Sunday April 16 and 17.
- 968 unique viewers watched into the Saturday program, and 577 unique viewers watched the Sunday program.
- The online program was watched by between 350 and 550 households at all times of the ten hour-long event.
- Information from the online evaluations:

- 93% rated the online Tour “Excellent”; 6% rated it “Very good”
- 64% were inspired to replace some of their non-native plants with natives
- 48% stated they were going to take steps to electrify their homes by installing solar panels, heat pumps, induction ranges, and so on.
- 30% of the viewers had not participated in the Tour previously

In-person Tour

- This year, for the first time, the Bringing Back the Natives Garden Tour was a two-day event
- 99% of those filling out the in-person Tour evaluations rated the in-person Tour “Excellent” or “Good.”
- 10,816 garden visits were made.
- 50 gardens were open on the in-person Tour.
- More than 200 hosts and volunteers made this event possible.
- 32 garden talks and demonstrations on a plethora of topics were given throughout the weekend of the in-person Tour.

Green Home Features

- Eight in-person hosts shared their green home features with Tour registrants, and two online tour hosts shared theirs. Solar panels and batteries, induction ranges, heat pumps for heating and cooling the house, heat pumps for heating water, Smart Panels, and more brought additional registrants to the Tour, and increased the number of in-person visitors at homes with these features.
- 82% of respondents who submitted evaluations “loved” the addition of the green home features.

Table of Contents

2022 Final Report

A nine-year study of water use, green waste generation, maintenance hours, and maintenance labor costs between a traditional garden and a California native plant garden was conducted by the City of Santa Monica between 2004 and 2013. ***The results of this study showed that the native garden used 83% less water; generated 56% less green waste, and required 68% less maintenance hours than the traditional garden.***

From the City of Santa Monica's garden/garden study

Why a Native Plant Garden Tour?

The spring 2022, Bringing Back the Natives Garden Tour was held in order to showcase pesticide-free, water-conserving gardens that provide habitat for wildlife, reduce solid waste, and contain 70% or more native plants.

The tour enlists local residents to demonstrate by example that seasoned and novice gardeners can garden with good results without the use of synthetic chemicals, and with minimal supplemental water, while providing food, shelter, and nesting areas for wildlife. The gardens on this tour show that it is possible to implement sustainable garden practices and still have beautiful places for people to relax in and enjoy. The goals of the Bringing Back the Natives Garden Tour are to motivate attendees to eliminate pesticide use, reduce water use, generate less solid waste, and provide habitat for wildlife in their own gardens.

Why California natives? Once established in the garden setting, California native plants need little or no summer water, as they survive naturally with only fall-to-spring rainfall. In addition to being water-conserving, California natives are hardy, and they don't require the use of pesticides and fertilizers, as many non-natives do. Native plants need less pruning than many non-natives, such as lawn, ivy, or cotoneaster, thus generating less green waste. As this article, "[The Chickadees Guide to Gardening]" demonstrates, native plants also provide the best habitat for birds, butterflies, beneficial insects, and other forms of wildlife.

A nine-year study of water use, green waste generation, maintenance hours, and maintenance labor costs between a traditional garden and a California native plant garden was conducted by the City of Santa Monica between 2004 and 2013.

The results of this study showed that compared to a traditional garden, the native garden uses:

83% less water
generates 56% less green waste, and
requires 68% less maintenance

Tour gardens contain minimal or no lawn. This is of particular value since the majority of the chemicals purchased by home owners support lawn care, and the majority of water used in home gardens is applied to lawns. According to the U.S. Fish and Wildlife Service, homeowners use up to ten times more chemical pesticides per acre on their lawns than farmers use on crops. In addition, half of the water used by the average household is applied to the landscape—with most of that water being used to keep turf green.

2022 Bringing Back the Natives Garden Tour events

3,036 people registered for this year's Tour. This year 1,208 new e-mail addresses were added to the Tour's database. This is a large number of new registrants. Some combination of the new events—online tour, two-day in-person tour, and/or the addition of the green home features attracted them.

Online Garden Tour

This year, for the first time, the Bringing Back the Natives Garden Tour was held both online and in-person.

The ten hour-long online Tour took place on Saturday and Sunday April 16 and 17. 968 unique viewers watched the Saturday program, and 577 unique viewers watched the Sunday program. (The Sunday program took place on Easter Sunday, which likely depressed the number of viewers.)

The program was seen by 550 households during the Tallamy talk, and at least 350 households were watching at all times of this two-day event.

Inspirational speaker Doug Tallamy was the keynote speaker, and his presentation was on the ecological value of oaks. The on-line Tour featured talks on the best native plants for sunny and shady areas, and nine gardens were visited.

The recording of the online Tour has been put on the Tour's YouTube Channel, both as the full day recordings, and as individual segments. The videos on this year's Tour will receive more exposure over time; the Tour's YouTube channel has had more than 100,000 views in the last 2.5 years, and has close to 2,000 subscribers.

Online Tour evaluations

93% rated the online Tour "Excellent" and 6% rated it "Very good"
82% of respondents "Loved" the inclusion of the green home features
64% were inspired to replace some of their non-native plants with natives
48% stated they were going to take steps to electrify their homes by installing solar panels, heat pump, induction ranges, and so on.
40% of those who filled out the online Tour evaluation attended both the online and in-person tours.
30% of the viewers had not participated in the Tour previously

Below are comments taken from online Tour evaluations:

- The tour is simply spectacular this year. So professional and beautiful. Thank you.
- Todays' entire presentation was amazing. So many good topics.
- It amazes me how much information and inspiration you packed into five hours.
- Thank you, thank you for the excellent presentation today! The schedule, your hosting, the videos, every bit of it was superb!
- Great job! Great links to lists of nurseries, water districts, professional designers, maintainers, etc. Delighted to have something so useful, beautiful, & meaningful to tell my friends about in advance of the event, and also that friends can experience online after the fact--that is HUGE for encouraging conversations in the future. Thank you.
- FANTASTIC.
- Love having the online program and your great online resources.
- Loved the virtual aspect, which allowed me to attend without having to go somewhere. Also, seeing the gardens online allows me to preselect where I want to go for the in-person tour. Everything was so well done--very organized and professional. And the presenters were terrific.
- The Tour just gets better every year! I am amazed at how much content and creativity I am able to learn from at home. The videos are so grand

and it’s great that the presenters are so willing to share all their knowledge. Kathy K. deserves huge kudos for running everything so efficiently. These are some of the best Zoom webinars I have been privy to.

- It was a fabulous presentation.
- Thank you very much for all the information. I’ve loved gardening all my life, thanks to my grandmother and mother, but now there’s added passion for native planting moving forward.
- These was very good production quality to the online program – it was lively and entertaining.
- Fabulous! This is an indescribably valuable resource & vehicle for positive change.
- The whole program of Bringing Back the Natives: virtual tours, in-person tours, resources, organization of a complex set of presentations—is simply awesome! I don't think there is another program like this of such excellence!

In-person Garden Tour

This year, for the first time, the Bringing Back the Natives Garden Tour was a two-day event, with Bayside gardens (Pinole to Fremont) open on Saturday, April 30, and Inland gardens (Martinez to Livermore, including Orinda and Moraga) open on Sunday, May 1.

The fifty gardens open on the in-person Tour were located in twenty-four cities and unincorporated areas in Alameda and Contra Costa counties. This is the highest number of cities that have had gardens on the Tour in one year. The cities were: Alameda, Alamo, Albany, Berkeley, Castro Valley, Clayton, Concord, Danville, Discovery Bay, El Cerrito, El Sobrante, Fremont, Livermore, Martinez, Moraga, Oakland, Orinda, Piedmont, Pinole, Pleasant Hill, Richmond, San Leandro, San Lorenzo and San Pablo.

A variety of gardens were featured on the tour. The gardens ranged from Al Kyte's fifty-year old wildlife habitat to a number of gardens that had been recently installed, and from large lots in the hills to small front gardens in the flats. Tour gardens contained everything from local native plants to the horticulturally available suite of natives from throughout California. About half of the gardens were designed and installed by owners, and the other half were designed and installed by professionals. All of the gardens were landscaped with at least 70% native plants.

150 volunteers and more than 50 hosts were stationed at gardens on the day of the tour, or helped with tour preparation and clean-up. The volunteers contributed more than 600 hours of time to the tour. The hosts put in countless hours preparing for the tour, and more than 400 hours on the day of the event.

Number of garden visits made on the day of the Tour

On the week-end of the event 10,816 garden visits were made. See the end of this report for a list of the number of visitors counted at each garden.

Native Plant Extravaganzas

The Bringing Back the Natives Garden Tour has now expanded its offerings to include not only the spring Tour, but also a series of Native Plant sales (held in October, February, April, and the week-end following the Tour). Participating nurseries are East Bay Wilds, the Watershed Nursery, and Green Thumb Works.

Green Home Features

This year, eight in-person hosts who had electrified their homes shared their green home features with Tour registrants (look for the "Green Home Features!" tag). In addition, two green homes were featured during the online tour. Solar panels and batteries, induction ranges, heat pumps for heating and cooling the house, heat pumps for heating water, Smart Panels, and more brought additional registrants to the Tour, and increased the number of visitors at homes with these features.

82% of those who submitted evaluations "loved" the addition of the green home features.

Garden Talks and Special Events

32 garden talks and demonstrations on a plethora of topics were given throughout the weekend of the in-person Tour. See Appendix B for the complete list.

Special events included bird-watching, demonstrations of induction cooktops, a leaf-rubbing children's activity, and music in the gardens.

The website

The website contains information and photographs of all of the gardens that have ever been on the tour, under "Find a Garden"; this section contains extensive garden descriptions, plant lists for each garden, and some garden-specific bird, butterfly, mammal, reptile, and amphibian lists. Resource information on the website includes contact information for landscaper designers who specialize in creating native plant gardens ("Find a Designer"), lists of nurseries that carry native plants ("Find a Nursery"), a list of Easy-to-Grow East Bay Natives, "How I got started gardening with native plants" essays by a number of the host gardeners, and more.

Tour Partnerships

The Bringing Back the Natives Garden Tour has created partnerships with a variety of organizations that share common values—that chemical-free and water-conserving gardening preserves water quality and quantity, and creates wildlife habitat. The list of major sponsors and supporters of the 2022 Tour include a flood control and water conservation district, two county clean water programs, six water districts and water conservation agencies, four cities, a non-profit, and several businesses. The list of tour sponsors is provided below.

Sponsors of the 2022 tour

$16,000
Contra Costa Clean Water Program

$10,000
Alameda County Flood Control and Water Conservation District

$5,500
Contra Costa Water District

$5,000
Clean Water Program, Alameda County

$3,000
Bay Area Water Supply and Conservation Agency

$2,000
Carol Baird and Alan Harper
California Native Plant Society (East Bay Chapter)
EcoPerformance Builders

$1,500
City of El Cerrito
City of Pittsburg

$1,000

Alameda County Water District
Atmos Financial: Green Banking Services for Climate Change
City of Antioch
City of Walnut Creek
Zone 7

$800
In memory of our friend, Sue Duckles, from the Wednesday Hiking Group

$750
Glen and Connie Schneider

$500
Anne Chambers and Ed McAlpine

Host Gardeners

The gardens selected to take part in the tour are chemical-free and water-conserving landscapes that provide habitat for wildlife and contain 70% or more California native plants. Hosts were chosen because of their willingness to be on-site on the day of the tour to talk with visitors about their gardens, and their enthusiasm for, and commitment to, educating others about how to garden in environmentally sustainable ways.

Host gardener recruitment began in the spring of 2021 for the 2022 tour. Potential candidates completed an application, and applicants who met the criteria received a site visit.

Host's gardening experience ranged from native plant novices to professional landscape designers. All of the host gardeners were good ambassadors for natural gardening techniques.

Host Comments from the 2022 evaluations

> We discussed with visitors our reduced water use and elimination of pesticides repeatedly on the day of the Tour.
>
> Some visitors were surprised about the low maintenance required for native plants and also about the fact that that no pesticides or herbicides are used in our garden. And that the lower water usage is a bonus for growing beautiful native plants that draw wildlife.
>
> Many visitors asked about my water use, which is so minimal. When one was concerned about how much her one plant was being eaten, I congratulated her.

We had many questions on irrigation and, as we had sheet-mulched, how we were able to use our former lawn as the base for our new native garden, covering it with planting mix, compost, cardboard and mulch.

We heard from many tour visitors that seeing multiple gardens and talking to owners helps to inspire and promote gardening with natives.

The question I was asked most often was how often I watered, and how.

Many guests talked to me and the Garden Assistant about water and pesticide use.

We are really amazed at how many attendees have questions - some on gardening, some on the cost and process of re-landscaping, and certainly on our water use and irrigation.

As a host, it was fun to see how much interest there is from the community in planting natives. It's nice to be part of this education effort!

People arrived happy. I'm not sure how you managed that, but it's a wonderful reflection on the tour itself.

The Bringing Back the Natives Garden Tour is a wonderful service in terms of providing information to the public. The fact that so many people have questions reinforces the value of the tour.

Thank you for continuing this tour! Thank you for your commitment to native plants and to having the confidence in me that my garden could represent what can be done in a neighborhood that doesn't yet have many native gardens around. (I say yet...because now it might change minds....)

Because of Kathy's support of our efforts all these years, we are now getting a significant response from our local community.

It’s a wonderful event. Thank you for organizing it for so many years, and inspiring thousands and thousands of East Bay residents to discover native plants

Volunteer Comments from the 2022 evaluations:

Today was a beautiful gift—so much happiness was seen on the tour. This joy is in addition to all of the positives that come with encouraging folks to go native. I was thrilled to be a Greeter and witness so much enthusiasm and friendliness.

It was good to see so many people interested in drought tolerant native gardens.

Lots of things worked well. The volunteers’ duties were clearly spelled out, and my host was well-organized, welcoming, and appreciative. Your map and list of addresses was well organized, and it was quite easy to see which gardens where in the same area. I loved the very noticeable "Bringing Back the Natives Garden Tour" signs with the beautiful Saxon Holt photo. The check-in process at each garden was easy, and every garden seemed to have lots of good information to give away. I’m very happy that this year was a hybrid tour, both virtual and in-person.

> I am a great admirer of the tour. It was handled so well during the shutdown, and it keeps getting better.
>
> Thanks for putting this tour on every year, I hope to have my garden on it one day!

Registration Survey and Evaluation

Two surveys were offered to Tour participants. The first was available as part of the registration process.

What registrants wanted to learn from the Tour:

How to select native plants	70%
How to garden for wildlife	59%
How to reduce water use	53%
About green home features	36%
How to reduce or eliminate pesticide use	24%
How to replace a lawn with a garden	23%
How to compost	20%

Registrants were also asked about their lawns

I have lawn and want to remove it	18%
I have lawn and plan on keeping it	9%
I have no lawn	48%
I don't have anywhere to garden	3%

Post-Tour Evaluation

A post-event survey was e-mailed after each of the online Tour event, and also each morning of the in-person tour.

There were 206 responses to the in-person tour evaluation. Below are statistics taken from the post-tour survey.

- 99% of those filling out the in-person tour evaluations rated the tour "Excellent" or "Good."
- 40% of respondents had participated in both the online and in-person tours.
- Percent of people visiting gardens on:
  - Saturday, April 30 – 55%
  - Sunday, May 1 – 30%

Both days – 20%

Visitors went to
3-5 gardens – 38%
6-8 gardens – 30%
1-2 gardens – 16%
9-11 gardens – 9%
12 or more gardens – 7%

2022 Tour Gardens and Number of Visits Made			
	AM visits	PM visits	Total visits
Bayside Gardens			
Alameda			
Michelle Minor and Milt Friedman	55	55	110
Gretchen Pivonka	45	47	92
Albany			
Beatrice and Bjorn Hori	100	69	169
Sue Mellers	90	113	203
Joanna Reed and Paul Fine	92	108	200
Scott Richerson	126	128	254
Leslie Zander	104	166	270
Berkeley			
Sallie Bryan	112	193	305
Leslie Buck	167	168	335
Ruth Rogow	75	136	211
Phyllis Rothman	82	86	168
Dave Savidge and Jennifer Braun	89	122	211
Castro Valley			
Danny Galindo and Eugene Shabelyanau	140	121	261
Cindy and Richard Simons	53	71	124
El Cerrito			
Michael Graf	74	126	200
El Sobrante			
El Sobrante Library	40	19	59
Fremont			
Ed Ellebracht	60	26	86
Joel Lym	48	27	75
Oakland			
Carol Baird and Alan Harper	120	255	375
Robert Finkel	141	185	326
Carolyn Rashby	85	173	258
Ilene Levinson	113	221	334
Ashley and Matt Spinelli	117	163	280
Victoria Gardens Pollinator Corridor	117	163	280
Piedmont			
Nancy McKee-Jolda and Robert Jolda	120	120	240
Hope and Larry Salzer	256	151	407
Pinole			
Jen and Rolland Mathers	63	38	101

Richmond			
Paul Glodis and Mary Jo Sanders	46	62	108
Oliver Lo	45	62	107
Anita Periera	74	33	107
San Leandro			
John and Amy Olson	117	139	256
Stefanie Pruegel	136	163	299
San Lorenzo			
San Lorenzo High School's Native Plant Garden	100	129	229
San Pablo			
Melody Esquer Gil	29	12	41
Inland Gardens			
Alamo			
Patricia Ramsay and Shawn O'Leary	131	131	262
Clayton			
Karen and Jeremy Amos	127	101	228
Nancy Niemeyer	127	89	216
Kelly Marshall and Mike Weidner	148	105	253
Concord			
Laura Spain	75	92	167
Dan and Lisa Wanket	111	149	260
Discovery Bay			
Linda and Gary Williams	10	4	14
Livermore			
Carol and Don Hardesty	98	92	190
Rodrigue Molyneaux Winery	67	41	108
Martinez			
Chris and Marianne Dundon	100	106	206
Nancy Salsig	93	89	182
Moraga			
Al and Barbara Kyte	213	242	455
Anne Chambers and Ed McAlpine	213	194	407
Orinda			
Bob and Stephanie Sorenson	186	206	392
Pleasant Hill			
Gaston and Ariane Habets	167	228	395
Totals	5097	5719	10816

When planning for a year, plant corn. When planning for a decade, plant trees.

When planning for life, train and educate people.
(Chinese proverb)

Appendix A

Comments from 2022 Tour attendees

In-Person Tour

- I have been a longtime follower and was for many years a regular attendee of your amazing native plant garden tour. I'm continually impressed and astounded by your talent, dedication, excellence and inspired by the wonderful community you have created. I wanted to thank you for all the work you do to help educate, inform and inspire gardeners, environmental advocates, community members, etc. I'm delighted you are now including additional resources such as Doug Tallamy's talk, other gardening-related community activities, and your green home projects. I cannot mention resources to new Bay Area gardeners without referencing your amazing garden tour and events, and advising folks to get on your email list.
- The information that you share through the native garden tour is very impactful. I truly appreciate all I have been learning about native plants and am spreading the word.
- Love that you made it online and in person and that it was over two days. Also, loved that you keep adding new houses/cities throughout the East Bay to the tour.
- No room for improvement! Everything was so wonderful. I really enjoyed the online talks and the presentation on the oak trees and the sunny and shade gardening talks. Kathy is such an incredible host. My hats off to her and the garden hosts and all of the volunteers who helped with the gardens. I was greeted warmly by the volunteers in the gardens I visited.
- I so appreciate all your incredible hard work year after year on the tour! I think it is an amazing thing and it has definitely been both inspirational and motivational for me, and I know many, many others. 😍 (And now I'm spending half my daydreaming thinking about heat pumps and solar panels as well 🤣)
- I didn't expect to watch all five hours of the program today, but it was riveting. Thank you so much.
- This was my first time on the garden Tour; I found it truly inspirational.
- Thank you. You have been a continuous valuable resource for not just me, but my mom and friends.
- I've been so influenced by your content over the past four years that I've known about the tour. It had an enormous influence on what I have in my garden and how I went about everything. It would have taken me decades to figure this out if there wasn't a native plant event like the one you put on.
- I have attended your online garden tour and green house info this year and last; many years ago when you first started your garden tours, I attended with my mom. I just must tell you, I think you are doing an AMAZING job and providing an amazing service to the community by offering educational information on native gardens and now your green home information.I had already started my migration to native gardens but your garden tours, plant discussions, and plant lists have really been great. I always learn some invaluable bug

information, plant idea, plant placement idea. It is just terrific, thank you. Also, thank you so much for having Doug Tallamy guest speak. He is amazing as well, and I believe you have your finger on what we need to be doing to save our ecosystems, our flora, fauna, bugs, and our state.

- I loved having the opportunity to ask questions about maintenance, troubleshooting and transplanting from very knowledgeable people who were passionate about native gardens.
- I have been including native plants in my evolving garden for 20 years but only in the last year have truly begun to focus & understand how little support many nonnative plants provide to native insects & animals.
- I have a large steep slope in front of our house that has been bare for the last few years. I've already spoken to one landscape architect, but haven't decided what to do yet. Today inspired me to plant it all with California natives.
- Because of the online Tour I better understand how native plants benefit animal life in Ca.
- Thank you! We've loved the tour for years and are so glad in-person is back. We're bringing neighbor-friends this year with the hope of fostering an increased understanding of native gardening on our block.
- It was a joy to be able to visit many well-managed native gardens in the Bay Area.
- The tour was impressive and greatly exceeded my expectation.
- Well-organized and the day of the tours had ample volunteers and lots of valuable lectures and demos.
- The tour was impressive and greatly exceeded my expectation. Well organized and the day of the tours had ample volunteers and lots of valuable lectures and demos.
- The Tour was incredibly organized. I will do virtual tour first next year. Great job!
- I like that the Tour was spread out over two days. It was nice to get to see more gardens.
- Keep up the good work. The online presentation was terrific!
- I've been coming for many years, and I always get great new ideas. This tour is a real treasure. Thank you!
- Thank you for the wonderful program. Putting this program together must be all- consuming. I've become a much better, and more knowledgeable California native plant gardener since I started watching online several years ago. I promote California native gardening to anyone who will listen. I get great joy from watching my own garden grow and evolve.
- I know this is a massive undertaking and I greatly appreciate all the work that goes into making it happen. (I'm sure you start preparing for the next year the minute this year's tour ends.) I do love the lectures, tours, and recommendations—whether its places to buy plants, companies to use for yards/heating, etc. Love all the resources listed, and the opportunity to watch tours online.
- Extremely well-run and informative; very worthwhile, got a lot out of it
- The Tour was very inspiring. I've already contacted one of the designers on your list for a consult.

- Keep up the good work! I've been on the tour several times and it keeps getting better and better. What a great service to the community! Thank you.
- I loved it!
- Thanks for your hard work and dedication to the tour, and thanks also for adding the green home aspects to the Tour.
- I had a lovely day of touring the gardens. All the owners and volunteers were great!
- Great gardens! Fantastic selection of plants! Oasis in the city!
- It was wonderful! I learned so much; thank you for putting this together.
- I love this event and am so grateful for the organizers.
- Very nice hosts! Lovely gardens! Very grateful for the further inspiration.
- Thank you one and all for sharing your gardens and enthusiasm. Delightful!
- It was wonderful! The Garden Assistants and hosts were all so knowledgeable and helpful! I learned a lot.
- All the volunteers were so friendly and knowledgeable as were the hosts. It was so inspiring to know that there are so many like-minded people who care about the environment, the timing is so important. Thank you so much to each and every one of you for caring and being willing to extend yourselves to others.
- What a wonderful tour this year! Can't wait for next year!
- Thank you so much for doing this every year and for the wonderful online program during the pandemic. It is wonderful to see these gardens and become inspired by what we see.
- Fabulous, fabulous, fabulous. So well organized, great staffing at gardens, great supporting materials (maps, garden descriptions).
- Very well organized, very friendly folks. Lovely gardens!
- The tour this year was better than ever.

OnlineTour

- The tour is simply spectacular this year. So professional and beautiful. Thank you.
- The presentations, organization, and information exchange was extraordinary. It was a great day!
- I was really impressed by both the organization and the quality of information and presentation. I'm sure this has been a tremendous amount of work for all involved. Thanks for putting it on.
- Last year, Doug Tallamy's presentation on the desirability of caterpillars was a revelation to me. And there were soo many entertaining facts this year--oak-gall ink, non-periodical cicadas--and practical advice too. From now on, I won't assume insects are pests, and that will change my gardening practices.
- Excellent. Very informative and well thought-out and coordinated.
- Thank you for providing these wonderful tours and information. I wish I had learned about native gardening and its importance sooner.
- FANTASTIC.

Appendix B

Garden talks and special events

Talks with no time listed were given once; talks with times listed were given twice.)

“How to design a garden and attract birds to your garden” by Lois Simonds

“How to select California native plants for your garden” by Miri Malmquist

11:00 and 1:00 “It’s easier—and cheaper—than you think to transform your yard into a beautiful native plant garden. Come find out how we did it, and how you can, too!” by Joanna Reed and Paul Fine

“How to create a native plant garden that will attract birds, bees, and butterflies” by Sallie Bryan

The importance of a meadow garden” by Phyllis Rothman

“Why keystone natives?” or, “How to include beautiful native plants that attract birds, bees, and butterflies in your garden” by Ed Ellebracht

11:30 and 1:30 “Human uses of native plants: food, fuel, furniture and fun” by David Pepper

12:00 and 2:00 “Fire, erosion, and native grasses—balancing the threats while restoring native flora” by Alan Harper

“The evolution of a garden” by Robert Finkel

“Brick mounds, and how to build butterfly meadow gardens” by Andrea Hurd of Mariposa Gardening & Design

“How to select understory plants for a coastal forest setting” by Steven Cochrane, FCI Fine Gardening

“Got clay? Learn to understand, love, and use it to your advantage” by Tara Parker-Essig, Restoration Gardening

"Conscious integration of California natives into an existing landscape" by Lupe Peru, Alegre Landscaping & Design

Backyard biodiversity: How to select native species for your urban garden" by Naomi Vinbury

11:00 and 1:00 "Are you interested in our beautiful native grasses? Join me in wandering past the nearly 20 types of water-conserving, attractive, hardy, and great-for-wildlife native grasses in my garden!) by Hope Salzer

"How to attract birds to your garden" by Steve Wiley

"Gardening in the shadows" by John Olson

"You can do it! How to design a native plant garden like a pro" by Kelly Marshall

12:00 and 3:00 "How to sheet-mulch your lawn away!" by Laura Spain

"DIY lessons learned" by Linda Williams

10:00 "Seven steps to a water-wise landscape" by Chris Dundon

"Planning and maintaining your backyard fruit tree orchard" by Anne Chambers and Ed McAlpine

"Successful natives for sunny gardens" by Chris Garcia from Four Dimensions Landscape Design

11:00 and 12:00 "Gardening for native bees" by Elsa Zisook

"Al's best tips from fifty years of planting and growing California natives: a sit-down discussion" by Al Kyte

"Creating a native garden" by David Bigham

Special Events

10:00-4:00 Local bird experts Michael Strom and Karen Sorenson will be doing a 6- hour bird count on the day of the Tour! They will have a spotting scope set up and be available to answer your bird questions all day. Join them, and find out which birds you can attract to your own garden when you plant with California natives.

10:30 and 1:30 Demonstration of an induction burner by Suzanne Jones (at Stefanie Pruegel's garden)

• 11am & 1pm: Watch an induction stovetop cooking demo, and sample climate-friendly recipes – Suzanne Jones (at Anne Chambers and Ed McAlpine's garden)

• 1:30-5pm: Learn about BayRen energy efficiency rebates - Imma Dela Cruz

• 3pm: Music in the garden! Hear the Bindweed Sisters perform vocal harmonies with guitar, flute and percussion.

• 11:00-2:00 Tim and Mairead will play guitar and violin and sing some Irish folk songs

• All day: Climate-friendly cookbook sale – at four tour gardens

"Tesla solar roof and Powerwall batteries – our experience" by Anne Chambers and Ed McAlpine

Children's Activities
10:00–12:00 Learn how to make leaf rubbings! The toddler's playground will be open throughout the day - El Sobrante Library

Appendix C

Doug Tallamy article: "The Chickadee's Guide to Gardening"

OPINION: NY Times, March 11, 2015

The Chickadee's Guide to Gardening
By Douglas W. Tallamy
March 11, 2015

I GREW up thinking little of plants. I was interested in snakes and turtles, then insects and, eventually, birds. Now I like plants. But I still like the life they create even more.

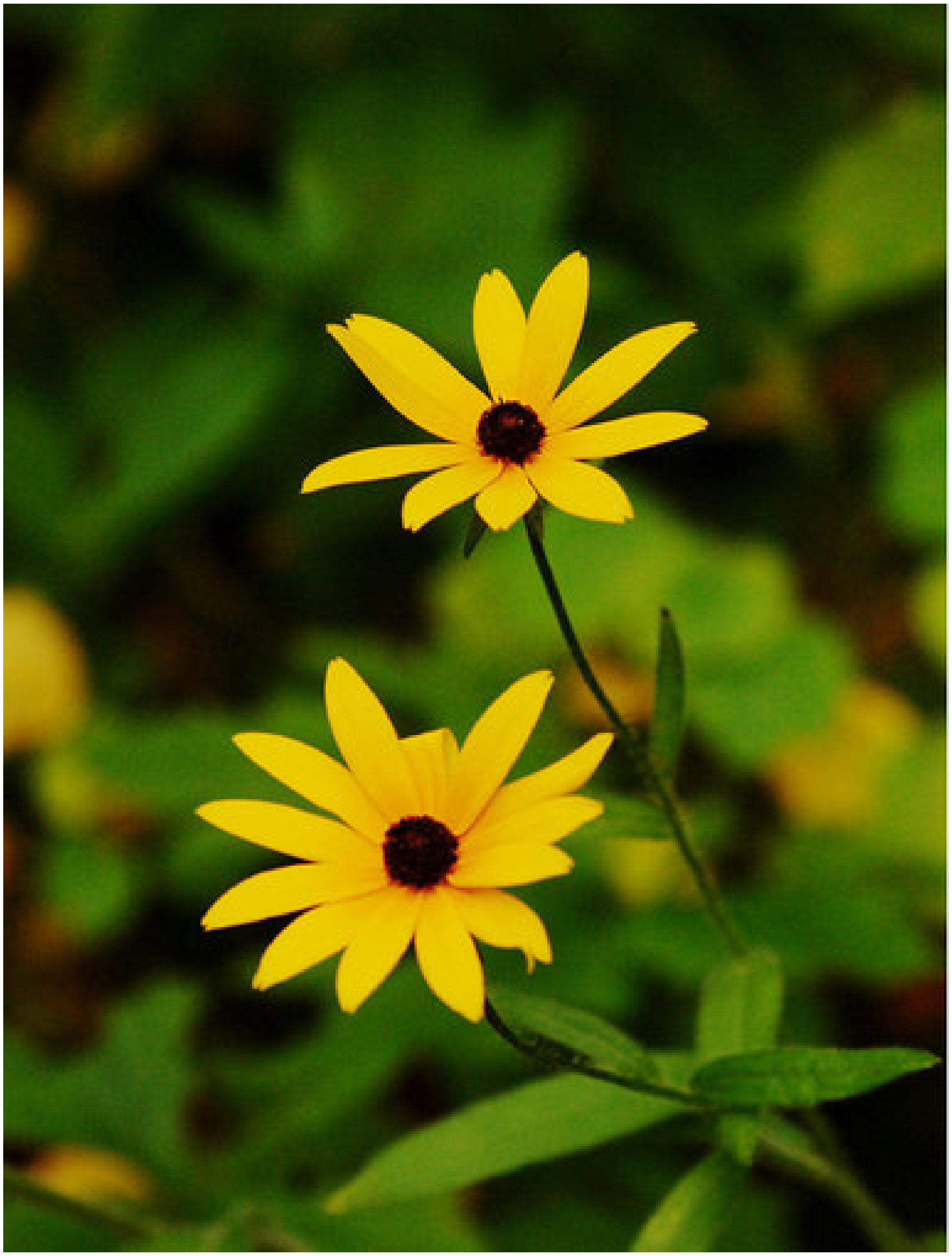
Plants are as close to biological miracles as a scientist could dare admit. After all, they allow us, and nearly every other species, to eat sunlight, by creating the nourishment that drives food webs on this planet. As if that weren't enough, plants also produce oxygen, build topsoil and hold it in place, prevent floods, sequester carbon dioxide, buffer extreme weather and clean our water. Considering all this, you might think we gardeners would value plants for what they do. Instead, we value them for what they look like.

When we design our home landscapes, too many of us choose beautiful plants from all over the world, without considering their ability to support life within our local ecosystems.

Last summer I did a simple experiment at home to measure just how different the plants we use for landscaping can be in supporting local animals. I compared a young white oak in my yard with one of the Bradford pears in my neighbor's yard. Both trees are the same size, but Bradford pears are ornamentals from Asia, while white oaks are native to eastern North America. I walked around each tree and counted the caterpillars on their leaves at head height. I found 410 caterpillars on the white oak (comprising 19 different species), and only one caterpillar (an inchworm) on the Bradford pear.

Was this a fluke? Hardly. The next day I repeated my survey on a different white oak and Bradford pear. This time I found 233 caterpillars on the white oak (comprising 15 species) and, again, only one on the Bradford pear.

Why such huge differences? It's simple: Plants don't want to be eaten, so they have loaded their tissues with nasty chemicals that would kill most insects if eaten. Insects do eat plants, though, and they achieve this by adapting to the chemical defenses of just one or two plant lineages. So some have evolved to eat oak trees without dying, while others have specialized in native cherries or ashes and so on.




Playing God in the Garden

By planting productive native species, we can create life.

But local insects have only just met Bradford pears, in an evolutionary sense, and have not had the time — millennia — required to adapt to their chemical defenses. And so Bradford pears stand virtually untouched in my neighbor's yard.

In the past, we thought this was a good thing. After all, Asian ornamentals were planted to look pretty, and we certainly didn't want insects eating them. We were happy with our perfect pears, burning bushes, Japanese barberries, porcelain berries, golden rain trees, crape myrtles, privets, bush honeysuckles and all the other foreign ornamentals.

But there are serious ecological consequences to such choices, and another exercise you can do at home makes them clear. This spring, if you live in North America, put up a chickadee nest box in your yard. If you are lucky, a pair of chickadees will move in and raise a family. While they are feeding their young, watch what the chickadees bring to the nest: mostly caterpillars. Both parents take turns feeding the chicks, enabling them to bring a caterpillar to the nest once every three minutes. And they do this from 6 a.m. until 8 p.m. for each of the 16 to 18 days it takes the chicks to fledge. That's a total of 350 to 570 caterpillars every day, depending on how many chicks they have. So, an incredible 6,000 to 9,000 caterpillars are required to make one clutch of chickadees.

And chickadees are tiny birds: just a third of an ounce. What if you wanted to support red-bellied woodpeckers in your yard, a bird that is about eight times heavier than a chickadee? How many caterpillars would that take?

What we plant in our landscapes determines what can live in our landscapes. Controlling what grows in our yards is like playing God. By favoring productive species, we can create life, and by using nonnative plants, we can prevent it.

An American yard dominated by Asian ornamentals does not produce nearly the quantity and diversity of insects needed for birds to reproduce. Some might argue that we should just let those birds breed "in nature." That worked in the past, but now there simply is not enough "nature" left. And it shows. Many bird species in North America have declined drastically in the past 40 years.

Fortunately, more and more gardeners are realizing that their yards offer one of the most empowering conservation options we have, and are sharing their properties with the nature around them.

By the way, you might assume that my oak was riddled with unsightly caterpillar holes, but not so. Since birds eat most of the caterpillars before they get very large, from 10 feet away the oak looked as perfect as a Bradford pear.

Douglas W. Tallamy, a professor of entomology and wildlife ecology at the University of Delaware, is the author of “Bringing Nature Home: How You Can Sustain Wildlife With Native Plants.”

A version of this article appears in print on March 10, 2015, on Page A25 of the New York edition with the headline: The Chickadee’s Guide to Gardening.

Attachment 9.1

Contra Costa Clean Water Program

Our Water Our World Store Partnership Program Report, 2021-2022

OUR WATER - OUR WORLD

Contra Costa Clean Water Program
Our Water Our World Retail Store Partnership Program

Contract Report 2021 – 2022

prepared by Suzanne Bontempo

Mentoring Evelyn, associates at the San Ramon Ace

Building OWOW displays at the Alamo Ace


Training associates at Annie's Annuals


Training associates at the Home Depot, Martinez

Table of Contents

Program Overview

The ‘Our Water Our World’ (OWOW) program is a public outreach program designed to reduce the use of pesticides by using a point of purchase program that educates and encourages retail nurseries, hardware stores, and home improvement stores that sell pesticides, to provide less-toxic, eco-friendly products for their customers. In addition, the OWOW program provides Integrated Pest Management (IPM) educational Fact Sheets for the public. The reduction of pesticide usage or the use of less toxic products around the home can lead to a reduction of pollutants in our local creeks, as well as a healthier environment for the public.

Contra Costa Clean Water Program currently sponsors the Our Water Our World retail partnership program in 34 retail businesses throughout Contra Costa County. Moraga Garden Center did close however we recruited a new store, Ace Alamo Hardware of Blackhawk in Danville, the newest retailer to join the partnership, joining in March 2022. The Ace Hardware in Pinole is also interested in joining the program partnership and is waiting to receive approval from their District Supervisor.

The contract lead is Suzanne Bontempo, with subcontractors Debi Tidd and Charlotte Canner assisting with OWOW services to the stores and outreach events.

Key associate, David at the Home Depot in Hercules with the new Vegetable Pest ID booklet

Numbers at a Glance:

- 34 stores participating in the partnership.
- 34 store set-ups with shelf talkers, fact sheet racks and supplemental materials.
- 34 stores have a QR code poster on display
- 23 OWOW store trainings provided
- 92 associates attended the OWOW trainings
- Virtual Outreach: 8 webinars provided, 1567 people registered, 771 attended = 49% attendance rates
- In-person Outreach: 3 tabling events, reaching no less than 67 people

OWOW Retail Partners:

Contra Costa Clean Water Program currently sponsors the Our Water Our World retail partnership program in 34 retail businesses throughout Contra Costa County

Alamo 1. Ace Hardware **Antioch** 2. Ace Hardware **Brentwood** 3. Ace Hardware 4. Home Depot **Concord** 5. Bill's Ace 6. Sloat Garden Center 7. Home Depot 8. Grow Generation **Danville** 9. Sloat Garden Center (Camino) 10. Sloat Garden Center (Diablo) 11. Ace, Alamo Hardware of Blackhawk **El Cerrito** 12. Home Depot 13. Pastime Ace Hardware **El Sobrante** 14. Oliver's Ace **Hercules** 15. Home Depot **Lafayette** 16. Orchard Nursery and Florist 17. Ace Hardware	**Martinez** 18. Bill's Ace Hardware 19. Sloat Garden Center 20. Home Depot **Moraga** 21. Moraga Garden Center **Oakley** 22. Ace Hardware **Orinda** 23. McDonnell Nursery **Pittsburg** 24. Home Depot 25. Ace Hardware **Pleasant Hill** 26. Sloat Garden Center 27. Ace Hardware **Richmond** 28. Annie's Annuals 29. The Urban Farmer Store **Rodeo** 30. Rodeo True Value Hardware **San Ramon** 31. Home Depot 32. Ace Hardware **Walnut Creek** 33. Ace Hardware (Ygnacio) 34. Ace Hardware (Mt Diablo)

Continued impacts of Covid-19 on the OWOW Program with the Retailer:

Though most of the Covid-19 restrictions have eased, the impact of this virus is still a challenge for the retail environment. Staff members who either have been exposed to or contract Covid do not come into work, leaving the already low staff compromised. Most retailers have not been able to hire enough employees already and with one out, the entire team is required to take on more work.

For OWOW trainings, both Debi & Charlotte had a challenging time getting these trainings scheduled. Then these trainings were most likely rescheduled or canceled due to staff shortages. This is not unique just to Contra Costa County. We are experiencing this across all other counties.

As for in-person tabling events, Charlotte was more comfortable working in the stores when it was possible. The tabling events were scheduled on days during the times of highest volume of customers. Even though Charlotte did her best to gauge the busiest days for her events, we now see that the brick & mortar retail nursery is affected by on-line shopping. We've also heard that many retailers are busier on weekdays rather than weekends. It is hard to judge.

OWOW tasks throughout the year:

Store set ups and Re-sets:

At each retail partner, OWOW Shelf talker tags are placed or replaced to identify the eco-friendly products, the OWOW literature rack with fact sheets and pockets guides is stocked, and a QR Code poster is accessible for the public to scan a fact sheet. The first months of each year is when most retailers remerchandise their products, adding new products and discontinuing others. Once a retailer has completed their new product sets, we then tag the eco-products to identify the less-toxic pesticides.

OWOW Shelf talker tags identify the eco-friendly products at this Ace in Martinez

OWOW Shelf talker tags identify the eco-friendly products at the Home Depot Stores

Fact sheets:

OWOW fact sheets are made available at each retailer in print form and/or digital form. These fact sheets provide the basic information for less-toxic pest management based off the information found on the UCIPM website. The OWOW fact sheets provide easy user friendly, easy to understand tools and techniques for pest management.

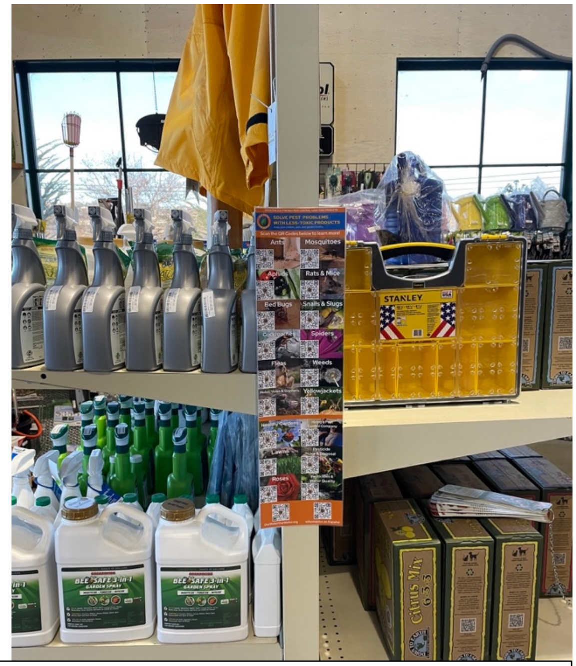
This is the current list of fact sheet available:

- Controlling **Ants** in Your Home
- Controlling **Aphids** in Your Garden
- Keep **Bed Bugs** Out of Your Home
- Keep **Cockroaches** Out of Your Home
- Keep **Fleas** Off Your Pests and Out of Your Home
- Planting a **Healthy Garden**
- Tips for a Beautiful, **Healthy Lawn**
- Protect Your Garden from **Moles, Voles and Gophers**
- Controlling **Mosquitoes** Around Your Home
- Hiring a **Pest Control Company**
- Keep **Rats and Mice** Out of Your Home
- Growing Beautiful **Roses**
- **Snails and Slugs** in Your Garden
- **Spiders** – The Helpful Hunters
- Pesticide **Use and Disposal**
- Controlling **Weeds** in Your Garden
- Controlling **Yellowjackets** Around Your Home

QR codes for digital fact sheets:

With the intention of keeping the OWOW program up to date and as an alternative to the printed fact sheets, Charlotte Canner and I developed trackable QR code for each fact sheets. The QR codes for each fact sheet have been developed as a poster to place on display on or near the OWOW rack and/or in the pesticide aisle for consumers to access with ease. The poster has been available as a single poster or split into two which allows us to place on the OWOW rack or in the aisle. This has been extremely well received by each retailer.

Two panel QR Code poster intended to be cut to place on each side of the OWOW rack



Single QR code posters on display at the Urban Farmer Store (photo left) and
at the Sloat Garden Center in Concord (photo right)

Split single panel QR code posters on display at the Pastime Hardware (left)
and at the Oliver's Ace Hardware (right)

Store mentoring and maintenance activities:

The IPM Advocates who assist as subcontractors for this contract provide the following services at each store visit:

- Replenish fact sheets
- Update shelf talkers on new products
- Ask associates if they are hearing of any new or unusual pest problems from their customers
- Focus on the pest of the month calendar
- Bring the quarterly UCIPM Retail Newsletter to each retailer
- Remind associates about the resource on the OWOW & UCIPM website
- Demonstrate how to use the UCIPM website for pest problem assistance
- Demonstrate how to access fact sheets through the QR code poster
- Guide customers to less-toxic solutions in the aisle
- Mentor buyer and manager at each retailer about new eco-friendly product on the market
- Mentor associates about the current pest problems and IPM strategies for the pests
- Mentor associates on how less toxic active ingredients work
- Follow up with emails and phone calls on pest questions from associates, as well as customers

Mentoring Ed at Rodeo Ace Hardware

Throughout the year, subcontractors Debi & Charlotte provided each store with monthly mentoring and support around assorted seasonal pest, such as aphids, earwigs, and cucumber beetle, along with leaf and plant diseases, especially powdery mildew, due to the dry conditions. Yellowjackets, gophers, rats & mice were also highlighted with many customers coming in the stores with these pests.

With California faced with another year of drought conditions, they also provided each retailer with more resources for keeping plants healthy through times of drought, how to efficiently water plants that reduces water usage, and the benefits of planting regionally appropriate plant material.

In addition to the monthly mentoring visits, per the request from several managers asking for additional OWOW educational resources, I started a monthly digital e-newsletter that is emailed to any of the associates who were interested in signing up. This is targeted specifically for the associates and is another way to share the seasonal pest support that both Debi & Charlotte provide on their monthly visits. If Debi and Charlotte are unable to connect with their key associates, then the information is still provided in a newsletter format. I also include upcoming events that such as OWOW webinars, IPM Advocate tabling events and other activities that are open to the public. I have included upcoming trainings that retail associates may find valuable such as the recent QWEL training, and ReScape Landscape Training Qualification.

Associates at Annie's Annuals (left) and Sloat Garden Center in Concord (right) with new educational resources we provided.

Extra educational materials:

In the fall we provided each retailer with the BASMAA handouts for keeping rainwater on sight. In the spring they provided each with how to keep gardens healthy through times of drought. They also provided each with the CA Pest Alert 'Keep the Spotted Lanternfly out of CA' to post, & the quarterly UC IPM Retailer Newsletter.

Extra handouts include:

- BASMAA's Rain Barrel & Cisterns
- BASMAA's Rain Garden Guide
- The Bay Friendly 'Guide to Mulch'
- CA Pest Alert Keep the Spotted Lanternfly out of CA' to post
- The quarterly UC IPM Retailer Newsletter.
- Dormant Spray for pest prevention
- 'Keeping Rats Out' of both home & garden
- UCANR publication IPM for Wildlife in Urban Area

New resources for Grow Generation

UCANR Educational publications for the nurseries:

With the request for more educational materials for associates, Debi & I decided to purchase a few of the most helpful UCANR publications. These easy-to-use publications will allow associates to better assist the many daily inquiries from their customers. We find that these publications are a better way for the associates to find support & solution rather than the online UCIPM website.

Spotted winged Lanternfly poster at the Oliver's Ace

I ordered the UCANR publications of (10) - '*Pests of Landscape Trees & Shrubs'* and (10) - *'Pests of Gardens and Small Farms'* specifically for the Sloat Garden Centers, Annie's Annuals, Orchard Nursery, McDonnell Nursery, and San Ramon Ace Hardware. Each of these retailers will benefit from these pest management books.

I purchased (30) - '*Vegetable Pest Identification for Gardens and Small Farms'* for the retailers that would benefit from using this resource. Each booklet is intended to be attached to the OWOW literature rack or to be used at the retailer's information desk.

Because Debi & Charlotte received these publications in June, not all the intended stores have received them yet, most have but not all.

Charlotte has attached the booklet to the rack or in the pesticide aisle at the following 17 retailers so far:

- Home Depot, San Ramon
- Ace Hardware, Pittsburg
- Ace Hardware, Martinez
- The Urban Farmer Store
- Pastime Ace Hardware
- Home Depot, El Cerrito
- Oliver's Ace Hardware
- Ace Hardware, Antioch
- Morgan's
- Ace Hardware, Oakley
- Ace Hardware, Brentwood
- Home Depot, Brentwood
- Rodeo Hardware
- Home Depot, Hercules
- Sloat Martinez
- Sloat Concord
- Home Depot, Concord

Robin at Sloat Garden Center appreciates the new UCANR pest educational books

The feedback has been terrific, the associates love these educational materials. Many have said that they will be extremely helpful resources for assisting with pest identification and less toxic, sustainable pest management. They LOVED this gift!

<u>Retailer Displays of Eco-Friendly Products:</u>

Over the past years, especiall once Covid impacted us, creating retail endcaps and display of eco-frendly products has been not available for IPM Advocates. We rely upon our influence to encourage the retailer, when appropriate, to build dislays featuring eco-friendly pest prevention and solutions.

We are thrilled to see this permanent endcap for eco-friendly seasonal pest management at the San Ramon Ace that Debi has been mentoring the staff there throughout the year.

We have seen many in the aisle ‘wing stack’ display at the Home Depot store. This one featured here is highlighting the Bio-Advance eco-pesticide that is a new product for the 2022 year.

OWOW display at the San Ramon Ace

Eco-friendly displays at the Home Depot Stores

<u>Store Associate Trainings:</u>

Debi and Charlotte conducted 23 training events combined with 92 associates trained.

Date	Retailer	Associates trained
10/15/21	Ace Hardware, Oakley	2 trained
11/13/21	Ace Hardware Brentwood	7 trained
11/18/21	Bill’s Ace Hardware, Martinez	2 trained
1/13/22	Home Depot Martinez	6 trained
1/14/22	Home Depot Martinez	6 trained
1/15/22	Annie’s Annuals	3 trained
1/23/22	Bill’s Ace Hardware, Concord	1 trained
2/22/22	Home Depot, Pittsburg	6 trained
3/17/22	Home Depot, Brentwood	11 trained

3/17/22	Bill’s Ace, Concord & Martinez	10 trained
3/22/22	Sloat Garden Center, Martinez	4 trained
3/25/22	Annie’s Annuals	3 trained
4/28/22	Sloat Garden Center, Concord	4 trained
5/5/22	Sloat Garden Center, Danville (Camino)	9 trained
5/18/22	McDonnell’s Nursery, Orinda	1 trained
5/23/22	Bill’s Ace, Concord	1 trained
6/7/22	Alamo Ace, San Ramon	2 trained
6/8/22	Sloat Garden Center, Danville (El Cerro)	4 trained
6/10/22	Sloat Garden Center, Pleasant Hill	1 trained
6/18/22	Sloat Garden Center, Concord	2 trained
6/20/22	Bill’s Ace Hardware, Martinez	1 trained
6/21/22	Home Depot, El Cerrito	4 trained
6/24/22	Alamo Ace Hardware Blackhawk, Danville	2 trained

The training sessions both Debi and Charlotte provided at each retailer were well received by each of the associates. Many shared how valuable they felt the information I provided was. Each associate is given a pre & post training survey to complete. A compilation of these training surveys can be view in the Appendix that follows.

Scheduling associate trainings for the retailer partners was still a bit challenging with the ongoing affects from Covid-19. Primarily the issue was associates being out due to covid. The other challenge for retailers was finding people to hire. Each retailer was faced with significant labor shortages, which lead to scheduled trainings to be cancelled or rescheduled. The trainings that they were able to complete were often with fewer associates. I am pleasantly surprised they were able to accomplish as many trainings and number of associates as they did!

The training classes are well received by each of the associates, as they see the value and appreciate the up-to-date IPM education I provide to them. This year continued to see an increase of new gardeners, we focused our attention on how to guide customers, these new gardeners, through the importance of adding compost to the soil, feeding plants organically, protecting the soil with mulch, and how to water to grow healthy plants, because when we grow healthy plants, they are more resilient and less likely to be affected by pest issues.

Debi and Charlotte also continued to provide information on how to protect gardens in times of drought. We continued to share resources and information about how to be very strategic with water, ways to recycle water such as easy to install laundry to landscape greywater systems, and products on the market to protect the plants with anti-transpiriants and water retaining soil polymers. Charlotte provided each of the retailers she works with the Guide to Mulch so that they could better understand the benefits the plants receive when mulch is applied properly and in accordance to the Cal-Fire recommendations.

Topics covered in the training:

- An OWOW partnership program overview
- Pesticides that are water pollutants of concern
- Where to dispose of local HHW
- How less-toxic products work
- IPM principles & techniques
- Beneficial Insect Identification
- Water Conservation
- Benefits of Compost
- Benefits of Mulch
- Water-wise plant choices for our area
- Pests highlighted: Aphids, ants, powdery mildew, citrus leaf miner, earwigs, fleas, gophers, rats & mice, snails & slugs, spider mites, whitefly, fungal diseases, codling moth, problem pesticides and how to address the many customer habits, such as how over fertilizing can increase pest populations. Also, the importance of adding compost to the soil and protecting the soil with a layer of mulch.
- Invasive pests: Asian Citrus Psyllid
- OWOW website, UC Davis IPM website, BIRC website
- The UC IPM YouTube informational channel

Training associates at the Home Depot in San Ramon

Training Materials - Resources Provided to Training Attendee:

Every associate who attends our OWOW training receives a folder of OWOW IPM resources to review as added education and support. Each folder includes the following:

- The Mac's Field Guide Good Garden Bugs of California
- Monthly Pest Calendar
- How to Apply Beneficial Nematode
- How Less Toxic Products Work handout
- Home Depot less toxic product list for the Home Depot Store training
- List of websites, books, and catalogs on a resource sheet
- Sheet Mulching instructions
- The CA DPR's 'How to read a pesticide label' handout
- Information on pest problem solving for the following pests: spider mites, lifecycle of grubs, whiteflies, spider

Training associates at the Home Depot in Pittsburg with their mites, citrus leaf miner, codling moth, keeping rodent out of the home and reducing their activity in the garden, Asian Citrus Psyllid, and the UCIPM Quick tips for Mealybugs & Powdery Mildew

- 10 Most Wanted Bugs for Your Garden brochure
- OWOW pocket guides
- A one sheet informational handout on 'Sheet Mulching', 'Protecting Landscapes in a Drought' and '10 Tips for Water-wise Gardening'

Comments provided by associates who attended OWOW trainings:

Charlotte as the instructor:

A+ presenter, very informative

Charlotte is great & super informative!

classes with HD customers

I learned a lot, and I am looking forward to learning more.

wonderful job, easy to understand

Debi at the instructor:

Thank you for your time today. (2)

Very useful.

Excellent program.

This was great and so helpful.

This was a very informative and inspiring class.

Keep up the great work.

Outreach Events: Webinars and In-Person Events:

Webinar events for the public:

In partnership with Sloat Garden Center, EBMUD, and the Moraga Garden Club, we provided 8 webinar presentation for the public, reaching a total of 1236 people with the OWOW IPM stormwater message. This number does not include those who registered for a webinar and did not attend. All who register for a webinar do still receive the digital resources I send and the link for viewing the recording on either the Sloat Garden Center or EBMUD YouTube channel.

Sloat Garden Center invited us to partner with them to provide educational webinars to the public. With their customer reach of over 5000, these webinars helped us expand our reach to larger audiences, introducing the attendees to the OWOW program and water pollution prevention message through the practice of Integrated Pest Management.

EBMUD also has invited OWOW to join with their educational programing. With EBMUD, they provide programs for the public and to landscape industry professionals. This is a wonderful honor to partner with them. I joined EBMUD as the presenter for 3 events they hosted.

Webinars provided throughout the year:

- **9/18/21: '*Fall is for Planting*' – 149 attended**, this webinar was in partnership with Sloat Garden Center, the recording has received 76 views
- **9/30/21: '*Fall Gardening Maintenance'* – 122 attended,** this bilingual webinar was in partnership with EBMUD (I don't see the recording on their YouTube channel)
- **10/21/22: '*Living with Drought'* – 25 attended,** this webinar was in partnership with the Moraga Garden Club.
- **2/2/22: '*Eco-friendly Rose Care'* – 85 attended**, this webinar was in partnership with Sloat Garden Center and the recording has received 87 views
- **3/2/22: *'Eco-friendly Management of Gophers, Moles & Voles'* – 135 attended**, this webinar was in partnership with Sloat Garden Center, the recording has received 137 views
- **3/16/22: '*Organic Houseplant Care'* – 112 attended**, this webinar was in partnership with Sloat Garden Center, the recording has received 40 views
- **3/24/22: 'Spring Garden Maintenance' – 158 attended,** this bilingual webinar was in partnership with EBMUD, the English recording has received 25 views, the Spanish recording has received 11 views
- **6/13: EBMUD presentation for the Landscape Advisory Committee – 74 attended**

Webinars from the 2020-21 fy are still receiving views:

- **1/9/21: '*Winter Garden Essentials*' – 170 views**
    - 345 attended, this webinar was in partnership with Sloat Garden Center
- **1/16/21: '*Compost & Soil Health Basics'* – 259 views**
    - 190 attended, this webinar was in partnership with Sloat Garden Center
- **2/6/21: '*Fertilizing Basics'* – 218 views**
    - 135 attended, this webinar was in partnership with Sloat Garden Center
- **3/6/21: '*Waterwise Gardening 101'* – 134 views**
    - 155 attended, this webinar was in partnership with Sloat Garden Center
- **3/20/21: *'Grow Your Own Organic Veggies'* – 89 views**
    - 126 attended, this webinar was in partnership with Sloat Garden Center
- **4/17/21: '*Learn to Identify Beneficial Insects'* – 126 views**
    - 114 attended, this webinar was in partnership with Sloat Garden Center
- **5/1/21: '*Eco-friendly Pest & Disease Management'* – 84 views**
    - 149 attended, this webinar was in partnership with Sloat Garden Center
- **6/2/21: *'Protecting the Garden During Drought'* – 122 views**
    - 194 attended, this webinar was in partnership with Sloat Garden Center

The virtual education for the public continues to prove a reach beyond what we can with an in-person tabling event. This is very much due to the wonderful support OWOW receives from Sloat Garden center and EBMUD, that includes their amazing promotional support. It's been incredible to have this opportunity to deliver the OWOW message to such a broad reach.

Each registrant received an email from me that included a program outline, and a 'Helpful Gardening Resource' page. This was created to help the guest with writing notes and help them pay attention without needing to scramble to note each website references throughout the program.

The 'Helpful Resources' I created for the webinars in partnership with the Sloats can be found in the Appendix.

OWOW Webinars are Training Tools for the Sloat Garden Centers:

The Sloat Garden Centers encourage associates to watch the recordings from our OWOW educational webinars that are archived on their website and on their YouTube channel. They refer to this as the **Sloat Garden Center 'Our Knowledge is Growing' Bonus Program**. Associates watch the recorded webinar then are required to write down 5 things they learned from the webinar, which resources they can use that relate to this program, such as OWOW fact sheets, the OWOW '10 Most Wanted' brochure, the UCIPM Quick Tips, and other Sloat resources. Throughout this 2021/22 contract year 45 associates viewed assorted webinars. This is so incredible!

In-person tabling events:

Charlotte provided 3 in-person tabling events engaging with 81 people.

- **2/26/22: Home Depot San Ramon**, **engaging with 28 people**

  Topics she discussed eco-pest solution included:
  - Rats indoors & outdoors - most common question
  - Gophers - 2nd most common question
  - Fungus gnats
  - Fruit Flies
  - Codling moth - customer took photo of the UC IPM quick tip I had
  - Deer
  - Indoor plants - ZZ plant
  - Yellow Jacket traps
  - Birds
  - Spiders
  - Snails & Slugs
  - Oriental Fruit Moth - had to look at UC IPM website together with customer
  - Peach Leaf Curl
  - Introduced the program to a few people
  - I gave out a few Fact Sheets.

  She also provided an OWOW training to new employee, Alma B.

Charlotte tabling in-person at Annie's Annuals, Richmond

- **3/12/22: Annie's Annuals, engaging with 40 people**
  - She introduced the OWOW program to at least 14 of those people.

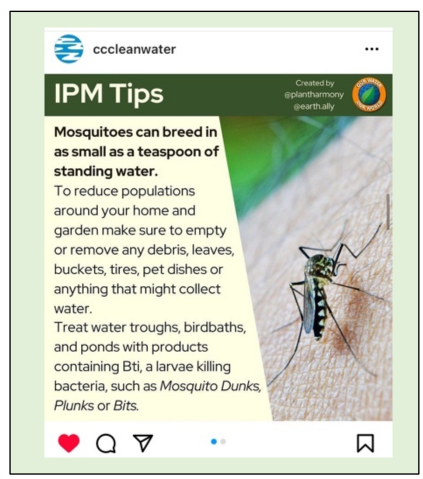
    - Some of the pest topics discussed were whiteflies, gophers, parasitic wasps, indoor pepper growing and managing aphids indoors, drought tolerant plants, salvias, blueberries, blood meal vs feather meal, and planting mix vs potting mix.
    - She spoke with associates Ixia and Cindy about Aphids, fire blight, fertilizer, and Peach leaf curl.

- **6/18/22: Sloat in Concord, engaging with 13 people**
    - Even though it was their Solstice Sale weekend, Dustin (the manager) said it was extremely slow, even for a regular Saturday. Because it was so slow, she used the time to train 2 associates, Emily & Brayden. Emily was extremely excited to learn and is passionate about eco-friendly gardening. She spoke with 13 customers during the tabling. Some of the topics discussed were:
        - Spider mites - they bought Mite X and I gave them the UC IPM Quick Tip
        - Powdery Mildew on Crape Myrtle, the customer had pruned and used several recommended tactics already. I think they bought copper fungicide.
        - Ants in the home - we looked at DE, Terro baits, Orange Guard, I gave them the Ant fact sheet
        - Gopher baskets
        - I gave two kids the 10 most wanted handout
        - Choosing a fertilizer for corn
        - Lose your Lawn and sheet mulching
        - I helped a customer put together a codling moth trap, gave them an introduction to IPM
        - Powdery Mildew
        - Earwigs - traps and Sluggo Plus

OWOW IPM Tips for social media:

Nine (9) Bilingual 'OWOW IPM Tips' content to post on the CCCWP social media accounts were provided:

- 'Hiring a Professional'
- 'Dormant Sprays'
- 'How to Manage Weeds'
- 'Preventing Yellowjackets'
- 'Growing Healthy Roses'
- 'Compost'
- 'Organic Fertilizers'
- 'Benefits of Mulch'
- 'Mosquito Prevention'



OWOW program influencing eco-friendly decision making in the aisle:

I continue to work with the Home Depot corporate to keep them up to date on store activates and events. We discussed additional ways to expand our partnership. They are happy for the recent OWOW statewide expansion with CASQA.

Many of the retail partners have witnessed an increase in sales with the eco-friendly alternative pesticides. Even throughout the challenges the year faced with covid spikes, labor shortages and water restrictions, we see that people are looking for alternative to the toxic pesticides. This trend has continued throughout the retail markets. Over this past year all the retailers have increased the number of eco-pesticides as they replace problem pesticides with these alternatives.

- The Urban Farmer Store is 'always increasing the eco-friendly pesticides they sell', replacing problem pesticides as they sell through.
- Bill's Ace, Martinez has seen an increase of eco-friendly pesticide sales of approximately 10%
- Grow Generation has seen a decrease of approximately 4% of the non-ecofriendly products and have a goal to sell only eco-friendly products
- Annie's Annuals has seen a 10% increase in sales of eco-friendly products.

The overall comments and response from the management teams towards the effectiveness of the OWOW program is phenomenal.

- Several believe that the shelf talker tags are very effective, with a few mentioning that they are somewhat effective
- Approximately 60% believe that the OWOW literature rack of fact sheets are very effective, with about 40% believe that it is somewhat effective
- All find the QR code poster to be effective in conjunction to the printed fact sheets stocked in the literature racks.
- All find the OWOW associate trainings to be effective
- All feel that the education we provide is very effective and valuable

Additional comments:

- *'We appreciate the continued support from the program manager'*
- *'The OWOW program is fine in every way'*
- *'Keep up the great work'*
- *'Charlotte is doing an amazing job!'*
- *'We'd love to see and OWOW mobile app'*
- *'We'd like more trainings for our associates'*
- *'You all are doing an excellent job'*
- *'We like to request OWOW associates trainings twice a year'*
- *'Thanks for all of the great work on providing us with great information'*

Most of the retail partners that were willing to provide us with information on the sales of eco-products have witnessed an increase in sales with the eco-friendly alternative pesticides. Gardening is treading heavily, and we see that people are looking for alternative to the toxic pesticides. Many of the retailers have increased the number of eco-pesticides as they replace problem pesticides with these alternatives. A few, such as Sloat Garden Center, only to sell less-toxic alternatives.

I continue to work with the Home Depot corporate to keep them up to date on store activates and events. We discussed additional ways to expand our partnership. The sale of eco-friendly products remains strong. The Home Depot stores continues to see a growth in the sale of alternatives to problem pesticides. This reflects consumer demand, that eco-friendly pesticides are more popular than ever.

Closing comments:

Each of the retailers in the partnership have been great to work with. All the associates we meet with at these stores are in full support of the OWOW program, happy to learn about the program & receive support. They are very open to learning about the new eco-products their retailer sells, tips for less toxic pest management, and how to better support their customers. Each year the ecofriendly product interest seems to increase, with more awareness for less toxic choices requested by the consumer.

The associates see the value with the OWOW partnership support, as this program provides them with education on the new products, how they work, and for the buyers what product they should bring in as an alternative to the problem pesticides. In addition to mentoring retail associates, each store appreciates the assistance when helping their customers in the aisle. This support of guiding the customers to choose a product that is less-toxic, also includes other IPM tools that the retailer may sell when a pesticide isn't necessarily the best solution, such as the importance of adding compost and organic fertilizer to your soil to increase plant health, choosing water-wise plants for longer term success, and the importance of mulch for water retention and optimum soil health.

Many of the managers requested additional OWOW training for their associates, suggesting a fall and a spring class to address seasonally relevant pest issues. We will do what we can to accommodate this request while working within the means of the annual program budget.

In close, I'd like to thank you for the opportunity to provide OWOW services with the assistance of Debi Tidd and Charlotte Canner to these retailers throughout Contra Costa County. An extra thanks to all the Clean Water Program partners for being flexible, to expand the OWOW outreach message through digital platforms, which has continued to provide me the opportunity to execute the valuable message of the OWOW program. Debi, Charlotte & I very much appreciate being able to reduce pesticide pollutants by sharing IPM knowledge, by offering support around stressful pest problems, and by being available to guide folks to less toxic, sustainable pest & gardening solutions.

Thank you so much for allowing me to lead the contract.
With great appreciation,

Suzanne Bontempo

Appendix

Summary of Store Training Pre-Training Surveys

A total of 18 trainings were conducted, 94 associates were trained,
92 pre-training surveys were returned.
Here are the results of those surveys.

1) Are you familiar with the OWOW program?
a) Yes: 34% b) No: 64% no response: 2%
2) When does urban runoff occur?
a) When a sprinkler is broken & excess water is running into the street: 2% b) During & after a rain event: 7% c) From watering or irrigation overflows: 2% **d) All of the above: 87%** no response: 2%
3) Which of these pollutants can be carried into the waterways with urban runoff?
a) Motor oil & solvents: b) Pet waste, debris & litter: c) Pesticides & synthetic fertilizers: 4% d) Household cleaning agents: 2% **e) All of the above: 92%** no response: 2%
4) Storm drains, including the storm drains in parking lots & loading docks, flow directly to:
a) The sanitary sewer that goes to the wastewater treatment facility: 27% **b) The nearest creek, river, bay, or ocean: 71%** no response: 2%
5) Are pesticides removed at the wastewater treatment facility?
a) Yes: 14% **b) No: 21%** c) I'm not sure: 64% no response: 1%
6) What is the best way to dispose of unused household hazardous waste, including pesticides & fertilizers?
a) Bury them in the garden b) Dump them into the trash: 4% c) Pour them down the sink or flush down toilet: 1% **d) Take them to the local HHW facility: 95%**
7) Do you know where your local HHW facility is located?
a) They do not know: 68% **b) Yes, they do know: 26%** c) Gave a good guess: 6%
8) Do your customers ask for eco-friendly solutions & less-toxic products that are safer for the environment?
a) Yes: 63% b) No: 16% c) Sometimes: 21%
9) What is the highly effective, science-based strategy for controlling pests in the home/garden that also helps to protect our waterways from toxic pesticide pollutants?
a) Synthetic pesticide program: 16% b) Homemade, D.I.Y. remedies & cures: 14% **c) IPM (Integrated Pest Management) Principles: 68%** no response: 2%

Summary of Store Training Post-Training Surveys

1) Are you familiar with the OWOW program
a) Yes: 94% **b)** No: 4% No response: 2%
2) When does urban runoff occur?
a) When a sprinkler is broken & excess water is running into the street: b) During & after a rain event: c) From watering or irrigation overflows: **d) All of the above: 98%** no response: 2%
3) Which of these pollutants can be carried into the waterways with urban runoff?
a) Motor oil & solvents: b) Pest waste, debris & litter: c) Pesticides & synthetic fertilizers: d) Household cleaning agents: **e) All of the above: 98%** no response: 2%
4) Storm drains, including the storm drains in parking lots & loading docks, flow directly to:
a) The sanitary sewer that goes to the wastewater treatment facility: **b) The nearest creek, river, bay, or ocean: 98%** no response: 2%
5) Are pesticides removed at the wastewater treatment facility?
a) Yes: 1% **b) No: 96%** c) I'm not sure: 1% no response: 2%
6) What is the best way to dispose of unused household hazardous waste, including pesticides & fertilizers?
a) Bury them in the garden: b) Dump them into the trash: c) Pour them down the sink or flush down toilet: **d) Take them to the local HHW facility: 98%** no response: 2%
7) Do you know where your local HHW facility is located?
a) Do not know: **b) Yes, knew: 54%** c) Gave a good guess no response: 46%
8) How can you identify products that are less toxic for pest management in your store?
a) The OWOW shelf labels that identify eco-friendly products: 1% b) The OWOW pest management fact sheets c) The OWOW website at www.ourwaterourworld.org d) Talking with an OWOW IPM Advocate: **e) All of the above: 98%** no response: 1%
9) What is the highly effective, science-based strategy for controlling pests in the home/garden that also helps to protect our waterways from toxic pesticide pollutants?
a) Synthetic pesticide program: b) Homemade, D.I.Y. remedies & cures: 1% **c) IPM (Integrated Pest Management) Principles: 98%** no response: 1%

Summary of End of Training Evaluation Form

1) You feel comfortable using the OWOW resources available in this store?
a) Yes: 98% b) No: 2% no response:
2) You understand a less toxic solution for at least one pest problem discussed today.
a) Yes: 98% b) No: no response: 2%
3) What type of support can the OWOW IPM Advocate provide you more of?
a) More print & online resources for less toxic pest management: 22% b) More information about seasonal pest problems and how to manage less toxically: 31% c) More OWOW training & product knowledge classes: 47%

Would you like to sign up to receive emails providing information about seasonal pest updates and educational event?
35 associates agreed to sign up to receive more information throughout the year – this is **38%** of those who attended the trainings.

OUR WATER — OUR WORLD

Resources for Gardening for the Bay Area

HELPFUL ORGANIZATIONS

- **Our Water Our World:** www.ourwaterourworld.org
  Pest fact sheets, updated lists of less-toxic products, and the retail store locator

- **Contra Costa Clean Water Program:** cccleanwater.org/community
  MCSTOPPP: marincounty.org/depts/pw/divisions/creeks-bay-and-flood/mcstoppp
  SFPUC: sfwater.org
  Information on protecting watersheds and reducing runoff, managing common pests, hiring eco-certified pest controllers and local events.

- **UC Statewide IPM Program:** www.ipm.ucdavis.edu
  Identification of pests; insects, diseases and weeds; detailed descriptions of pests and management methods.
- **Pesticide information and Pest identification:**
  - **National Pesticide Information Center:** npic.orst.edu
  - **Bug Guide**: bugguide.net

- **Gardening in Contra Costa County**: ccwater.com/740/Gardening-in-Contra-Costa-County
  Marin Gardening Resources: marinwater.org/gardening-resources
  SF Bay Gardening: sfbaygardening.com/resources/bay-area-planting-calendar/
  Watering Guide, garden photos, design and garden planning information, plant lists, garden maintenance schedules and resources for Contra Costa gardeners.

- **Greywater Action:** greywateraction.org
  Greywater Action is a collaborative of educators who teach residents and tradespeople about affordable and simple household water systems that dramatically reduce water use and foster sustainable cultures of water.
- **The Urban Farmer Store**: www.urbanfarmerstore.com
  A Bay Area resource for all of your irrigation needs, including greywater & rain catchment systems

- **Plant Harmony:** plantharmony.org or suzanne@plantharmony.org
  Visit this organic gardening site to contact our speaker with questions and to sign up for weekly gardening tips.
- **Earth Ally**: earth-ally.com
  Created by Charlotte Canner, IPM Advocate and educator. Visit this website to learn about gardening, composting, and supporting Mother Earth

- **Garden for the Environment**: gardenfortheenvironemnt.org
  San Francisco's public teaching garden
- **Master Gardeners:**
  Contra Costa: ccmg.ucanr.edu
  Marin: marinmg.ucanr.edu
  San Francisco: smsf-mastergardeners.ucanr.edu
  Garden education, resources, and demonstration gardens.

- **California Native Plant Society:** www.cnps.org
  Plant recommendations, sources of native plants, and publications aimed at conserving and appreciating native plants. Enter your zip code into their Calscape site for a list of plants suitable to your location: www.calscape.org
- **BAWSCA**: bawsca.org
  For landscaping classes, water saving rebates, gardening tools, and water wise gardening plant list
- **Arboretum All Stars:** arboretum.ucdavis.edu/arboretum-all-stars
  Details on growing and caring for 100 plants that are good choices for our area.

BOOKS

- **Attracting Native Pollinators:** Xerces Society, Storey Publishing, 2011.
  Information on providing flowering habitat and nesting sites for our native pollinators.

- **Gaia's Garden,** toby Hemenway, Chelsea Green Publishing, 2009. A practical introduction to permaculture with tips on building fertile soil, conserving water, creating habitat and growing edibles along with ornamentals.

- **Gardener's Guide to Common-Sense Pest Control**, Olkowski, Daar, Steve Ash, Taunton Press, 2013. A practical guide that offers effective pest management strategies with the least risk to people and the environment.

- **Landscape Pests Identification Cards**, Publication 3513, Larry Strand & Jack Kelly Clark, ANR Communication Services, 2011, order from ANR catalog: 1-800-994-8849. Pocket-sized, laminated cards are a handy reference to insect pests and diseases and management strategies for landscape plants.

- **Plants and Landscapes for Summer-Dry Climates**, EBMUD, 2004. A perfect resource for choosing plants for the Bay Area and designing a healthy garden that attracts beneficials.

- **Pests of the Small Garden and Farm**, Mary Louise Flint, UC Press, 1990 and **Pests of Landscape Trees and Shrubs**, Steve Dreistadt, UC Press, 1994. 1-800-994-8849 (ANR Catalog). Extensive color plates for identifying pests and diseases, detailed text on less-toxic management techniques.

- **What's Wrong With My Plant: A Visual Guide to Easy Diagnosis and Organic Remedies**, David Deardorff and Kathryn Wadsworth, Timber Press, 2009. Flow charts that help to accurately diagnose plant problems along with less-toxic management strategies.

PESTICIDE DISPOSAL

Household Hazardous Waste Collection Sites:

- Central County: 4797 Imhoff Place, Martinez, 800-646-1431
- West County: 101 Pittsburg Ave., Richmond, 888-412-9277
- East County: 2550 Pittsburg-Antioch Highway, Antioch, 925-756-1990
- Marin County: 565 Jacoby Street, San Rafael, 415-485-6806 marinhhw.com
- San Francisco: 501 Tunnel Ave, San Francisco, hhw@recology.com

Our Water Our World helps consumers find eco-friendly products for use in their homes and gardens and provides information on managing common garden and household pests.
www.ourwaterourworld.org

D. Tidd & S.Bontempo, suzanne@plantharmony.org 9/21

Attachment 11.1

Mercury and PCBs Watershed/Management Areas, Control Measures, and Load Reduction

Update 2022

CONTRA COSTA
CLEAN WATER
PROGRAM

MERCURY AND PCBS WATERSHED/MANAGEMENT AREAS, CONTROL MEASURES, AND LOAD REDUCTION – UPDATE 2022

Submitted in Compliance with Provision C.11.a.iii.(3), C.11.b.iii.(2), C.12.a.iii.(3), and C.12.b.iii.(2)

Municipal Regional Stormwater Permit
NPDES Permit No. CAS612008
Order No. R2-2015-0049

August 29, 2022

The Contra Costa Clean Water Program – A Municipal Stormwater Program consisting of Contra Costa County, its 19 Incorporated Cities/Towns, and the Contra Costa County Flood & Water Conservation District

This report is submitted by the agencies of the

CONTRA COSTA CLEAN WATER PROGRAM

Program Participants:

- Cities of: Antioch, Brentwood, Clayton, Concord, Danville (Town), El Cerrito, Hercules, Lafayette, Martinez, Moraga (Town), Oakley, Orinda, Pinole, Pittsburg, Pleasant Hill, Richmond, San Pablo, San Ramon and Walnut Creek
- Contra Costa County
- Contra Costa County Flood Control & Water Conservation District

Contra Costa Clean Water Program

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Tel (925) 313-2360
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Website: www.cccleanwater.org

Report Prepared By:

Geosyntec Consultants

on behalf of the
Contra Costa Clean Water Program

LIST OF ACRONYMS

BASMAA	Bay Area Stormwater Management Agencies Association
BMP	Best Management Practices
CCCWP	Contra Costa Clean Water Program
CIP	Capital Improvement Plan
GI	Green Infrastructure
GIS	Geographic Information System
mg/kg	milligram per kilogram
MPC	Monitoring and Pollutants of Concern Committee
MRP	Municipal Regional Permit
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
O&M	Operations and Maintenance
OES	Office of Emergency Services
PCBs	Polychlorinated Biphenyls
POC	Pollutants of Concern
POTW	Publicly Owned Treatment Works
ROW	Right-of-Way
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board
SFEI	San Francisco Estuary Institute
SSID	Stressor/Source Identification
TMDL	Total Maximum Daily Load
W/MA	Watershed / Management Area
WY	Water Year

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1 INTRODUCTION

1.1 Purpose

This *Mercury and PCBs Watershed/Management Areas*, *Control Measures, and Load Reduction – Update 2022* report was prepared by the Contra Costa Clean Water Program (CCCWP) per the Municipal Regional Permit (MRP) for urban stormwater issued by the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB; Order No. R2-2015-0049). This report fulfills the requirements of MRP Provisions C.11.a.iii.(3), C.11.b.iii(2), C.12.a.iii.(3), and C.12.b.iii.(2) for updating the list of control measures reported in 2020 as necessary to account for new control measures and to report loads reduced by these control measures using the approved Interim Accounting Methodology (BASMAA, 2017).

The following MRP reporting requirements are addressed within this report:

- The list of Watershed/Management Areas (W/MAs) where control measures are currently being implemented or will be implemented during the term of the Permit;
- The number, type, and locations and/or frequency (if applicable) of control measures;
- A cumulative listing of all potentially PCBs-contaminated sites Permittees have referred to the SFBRWQCB to date, with a brief summary description of each site and where to obtain further information;
- The description, scope, and start date of mercury and PCBs control measures;
- For each structural control and non-structural best management practice (BMP), interim implementation progress milestones (e.g., construction milestones for structural controls or other relevant implementation milestones for structural controls and non-structural BMPs) and a schedule for milestone achievement;
- Clear statements of the roles and responsibilities of each participating Permittee for implementation of identified control measures;
- Mercury and PCBs loads reduced using the approved assessment methodology to demonstrate cumulative mercury and PCBs load reduced from each control measure implemented since the beginning of the Permit term, including supporting data and information necessary to substantiate the load reduction estimates; and

- An estimate of the amount of mercury and PCBs load reductions resulting from green infrastructure implementation during the MRP 2.0 permit term, including a description of all data used and a full description of models and model inputs relied on to generate this estimate.

This report is organized into the following sections:

1. Introduction and Background – This section describes requirements for managing mercury and PCBs per the TMDLs and the MRP, followed by the management approach that will be implemented by the CCCWP Permittees. This approach includes delineation of W/MAs based on screening of priority parcels in Old Industrial land classification for likelihood of ongoing PCBs discharge and implementation of control measures. Roles and responsibilities are also described in this section.
2. Control Measures Overview – This section provides a general description of the types of control measures that are currently being implemented or will be implemented by the Permittees during this and future permit terms to control PCBs and mercury, and any specific assumptions used for load reduction accounting.
3. Watersheds/Management Areas, Control Measures, and Schedule for each Permittee – These sections describe the Permittee-specific W/MAs and control measures identified by the Permittee that are currently being implemented in each W/MA during the MRP 2.0 permit term.
4. Loads Reduced – This section presents the estimates of mercury and PCBs loads reduced by the control measures that are currently being implemented within Contra Costa County and within the MRP region.

1.2 Background

1.2.1 Mercury and PCBs Total Maximum Daily Loads

Fish tissue monitoring in San Francisco Bay (Bay) has revealed bioaccumulation of PCBs, mercury, and other pollutants. The levels found are thought to pose a health risk to people consuming fish caught in the Bay. As a result of these findings, California has issued an interim advisory on the consumption of fish from the Bay. The advisory led to the Bay being designated as an impaired water body on the Clean Water Act "Section 303(d) list" due to PCBs, mercury, and other pollutants. In response, the SFBRWQCB has developed Total Maximum Daily Load (TMDL) water quality restoration programs targeting PCBs and mercury in the Bay. The general goals of the TMDLs are to identify sources of PCBs and mercury to the Bay and implement actions to control the sources and restore water quality.

Municipal separate storm sewer systems (MS4s) are one of the PCBs and mercury source/pathways identified in the TMDL plans. Local public agencies (i.e., Permittees) subject to requirements via National Pollutant Discharge Elimination System (NPDES) permits are required to implement control measures in an attempt to reduce PCBs and mercury from entering stormwater runoff and the Bay. These control measures, also referred to as BMPs, are the tools that Permittees can use to assist in restoring water quality in the Bay.

1.2.2 Municipal Regional Permit

NPDES permit requirements associated with Phase I municipal stormwater programs and Permittees in the Bay area are included in the MRP, which was issued to 76 cities, counties, and flood control districts in 2009 and revised in 2015.

The MRP was amended on February 13, 2019, to add the cities of Antioch, Brentwood, Oakley, and the eastern portions of unincorporated Contra Costa County and the Contra Costa County Flood Control & Water Conservation District (the East County Permittees), which are located within the jurisdiction of the Central Valley Water Board (Region 5) and were previously covered under a separate Joint Municipal NPDES Permit titled "East Contra Costa County Municipal NPDES Permit". The East County Permittees have been implementing PCBs and mercury control measures and previous versions of this report summarized those implementation efforts and the associated load reductions. The amended MRP specifically exempts the East County Permittees from MRP Provisions C.11 and C.12, but does incorporate requirements for the Sacramento-San Joaquin Delta Estuary Methylmercury TMDL. Therefore, this report does not summarize PCBs and mercury control measure implementation or load reductions for the East County Permittees. For unincorporated Contra Costa County, this report summarizes the control measures implemented and the PCBs/mercury loads reduced within the SFBRWQCB Region 2 boundary.

Consistent with the TMDL plans, Provisions C.11.a. and C.12.a. of the MRP require the implementation of source and treatment control measures and pollution prevention strategies to reduce mercury and PCBs in urban stormwater runoff to achieve specified load reductions throughout the permit area. Specifically, the MRP requires the Permittees to:

1. Identify the watersheds or portions of watersheds (management areas) in which PCBs control measures are currently being implemented and those in which new control measures will be implemented during the MRP 2.0 permit term;
2. Identify the control measures that are currently being implemented and those that will be implemented in each watershed/management area;
3. Submit a schedule of control measure implementation; and
4. Implement sufficient control measures to achieve the mercury and PCBs load reductions stated in the permit[1].

Provisions C.11.b. and C.12.b. of the MRP require the Permittees to estimate loads reduced by the control measures that have been implemented since the beginning of the Permit term. The MRP allows for load reductions from control measures implemented prior to the effective date of the Permit to be counted toward the required reductions of the MRP 2.0 permit term if these control measures were established or implemented during the previous permit term, but load reductions from the activity were not realized or credited during the previous permit term (e.g., they were implemented after the 2014 Integrated Monitoring Report was submitted). Therefore, control measures implemented in Fiscal Year (FY) 2013/14, FY 2014/15, FY 2015/16, FY 2016/17, FY 2018/19, FY 2018/19, FY 2019/20, FY 2020/21, and FY 2021/22 (i.e., controls measures implemented between July 1, 2013 and June 30, 2022) may be reported herein.

1.3 Approach

1.3.1 Control Measures

The urban stormwater runoff wasteload allocation for PCBs represents a 90 percent reduction from the estimated existing load. The TMDL implementation plans set roughly 20-year timelines for achieving the reductions but also incorporate an adaptive implementation planning approach. The adaptive approach consists of the development of a plan that includes early implementation actions based on existing knowledge that have a reasonable probability of success and an overview of options for future actions. For PCBs and mercury in the Bay, the immediate or early

[1] Table 12.1 of MRP 2.0 lists interim PCB load reduction performance criteria that Permittees should achieve during the MRP 2.0 permit term. Provision C.11 does not list interim mercury load reduction performance criteria, except for green infrastructure implementation.

implementation actions are not expected to completely eliminate the Bay impairment. Therefore, future actions must be evaluated based on continued monitoring and response to the early implementation actions, as well as based on well-designed studies used for model refinement.

The MRP Fact Sheet notes that the initial focus of provisions C.11/12 is on measures designed to reduce PCBs, while also evaluating opportunities for mercury reduction. Implementation actions may fall into four categories depending on the available knowledge and confidence in a control measure's effectiveness (listed in decreasing order of confidence):

- Full-scale implementation throughout the region.
- Focused implementation in areas where benefits are most likely to occur.
- Pilot-testing in a few specific locations.
- Other: This may refer to experimental control measures, research and development, desktop analysis, laboratory studies, and/or literature review.

During the previous MRP term (i.e., MRP 1.0), Permittee effort was largely focused on gathering necessary information about control measure effectiveness through pilot projects and some focused implementation of the most effective control measures. In this term of the MRP (i.e., MRP 2.0), the emphasis has shifted towards focused and some full-scale implementation of the most effective control measures. Progress will be measured through accounting for specific load reductions as described in the report: *Interim Accounting Methodology for TMDL Loads Reduced* (BASMAA, 2017).

The Permittees, countywide stormwater programs, Bay Area Stormwater Management Agencies Association (BASMAA)[2], SFBRWQCB, and other interested parties (e.g., the Regional Monitoring Program) began gathering data and developing an understanding of the sources and pathways for mercury and PCBs in the Bay in the late 1990's. These same parties developed a framework to address these pollutants throughout the following decade.

[2] The dissolution of BASMAA occurred in June 2021. Coordination continues through ongoing communication of the former BASMAA member agencies and their representatives under a new moniker, Bay Area Municipal Stormwater Collaborative (BAMSC) via a Steering Committee and Subcommittees.

The Regional Stormwater Monitoring and Urban BMP Evaluation: A Stakeholder-Driven Partnership to Reduce Contaminant Loadings project funded by a State of California Proposition 13 grant and conducted by the San Francisco Estuary Institute (SFEI) defined conceptual models of sources and pathways of mercury and PCBs in Bay Area urban watersheds (McKee et al., 2006). The SFEI Proposition 13 project compiled PCBs and mercury chemical analysis results from about 600 sediment samples collected at over 360 locations throughout the Bay Area from roadways and stormwater drainage infrastructure (e.g., storm drain inlets, pump house wet wells, piping beneath manholes, and open channels) (Yee and McKee, 2010). These data supported the general hypothesis that concentrations of PCBs and mercury are elevated in specific parts of the urban landscape and showed that:

- Pollutant concentrations are highly patchy, even at moderate to small spatial (sub-kilometer) and temporal (approximately annual) scales. This patchiness reflects the episodic nature of many release and transport events and processes.
- Concentrations at sites within three kilometers of one another showed similarities in concentration, which may be due to similarities in land use, activities, or transport of shared pollutant sources.
- Individual sites and areas most contaminated with PCBs are often not those with high mercury, which is a logical finding given the different use histories and original pollutant sources.

Another outcome of the SFEI Proposition 13 project was a desktop evaluation of control measures for PCBs and mercury load reductions (Mangarella et al., 2010).

Building upon the efforts of the SFEI Proposition 13 project, BASMAA conducted an EPA grant-funded project called Clean Watersheds for a Clean Bay (CW4CB). The CW4CB project, which began in May 2010 and was completed in May 2017, is a collaboration among the MRP Permittees designed to evaluate the effectiveness of stormwater controls for PCBs and mercury. The CW4CB Project implemented a number of pilot projects for various control measures called for by the Bay PCBs and mercury TMDLs and the first term MRP. The CW4CB work products can be found on the BASMAA webpage[3] and included the following:

[3] https://basmaa.org/featured-programs-projects/clean-watersheds-for-a-clean-bay/

- Selecting five high priority subwatersheds that discharge urban runoff with PCBs and other pollutants to the Bay;
- Identifying PCBs and mercury source areas within the project subwatersheds and referring these sites to regulatory agencies for cleanup and abatement;
- Developing methods to enhance removal of sediment with PCBs and other pollutants during municipal operation and maintenance that remove sediment from streets and storm drain system infrastructure (e.g., street sweeping, and storm drain cleaning);
- Treatment control measure retrofits were designed and constructed in the public right-of-way, roadways, and easements;
- Facilitating development and implementation of a regional risk communication and exposure reduction program that focuses on educating the public about the health risks of consuming certain species of Bay fish that contain high levels of PCBs and mercury; and
- Creating public education outreach materials, project web portal, guidance manual, and technical workshops.

Monitoring data were collected for most of the pilot projects conducted as part of this project. The Permittees used the information gathered and lessons learned through the CW4CB project and the earlier projects as the basis to identify the W/MAs and control measures listed in this report.

In FY 2015/16, the CCCWP began development of a countywide Geographic Information System (GIS) pilot project focused on maintaining, analyzing, interpreting, displaying, and reporting relevant municipal stormwater program data and information related to Provisions C.10 (i.e., trash load reduction activities) and C.11/C.12 (i.e., PCBs source property identification and abatement screening activities).

With the adoption of MRP 2.0, the CCCWP expanded the countywide GIS C.3 Project Tracking and Load Reduction Accounting Tool to support additional compliance activities related to 1) C.3.b Regulated Projects reporting; 2) the C.3.j Green Infrastructure Planning and Implementation provisions; 3) the C.11 Mercury Controls and C.12 PCBs Controls provisions; and 4) C.10 Trash Load Reductions provision that provide shared benefits. This tool is critical to Permittees' ongoing work to identify watersheds and management areas where multiple-benefit control measure implementation opportunities have been identified and prioritized for implementation during the MRP 2.0 permit term and over the coming decades. Additionally, this GIS database is being used to track and map existing and future C.3 projects, allow ease of ongoing review of opportunities for incorporating Green Infrastructure (GI) into existing and planned Capital Improvement Plan (CIP) projects, and assist in the development of GI plans.

The CCCWP's stormwater GIS platform features web maps and applications created using Esri's ArcGIS Online for Organizations environment, which access GIS data, custom web services and reports that are hosted within an Amazon cloud service running Esri's ArcGIS Server technology. The CCCWP anticipates its expanded stormwater GIS platform will be an important tool for maintaining relevant stormwater data; reviewing, analyzing, and displaying data geography; accounting for and assessing compliance with load reduction performance goals; and reporting. The data used for this platform originated from many sources over the last decade and is being reviewed and updated as needed to reflect current land uses and implementation of C.3 projects as new and redevelopment occurs.

1.3.2 Watershed /Management Area Delineation

Each Permittee has created a list of W/MAs and control measures (i.e., a control measure plan that describes what, where, and when control measures will be implemented) for PCBs and mercury, provided in the sections below. The ultimate goal for the listed control measures is to achieve the Contra Costa countywide PCBs load reductions listed in MRP Tables 12.1 and Table 12.2 and the mercury load reductions listed in MRP Table 11.1 during this MRP term:

- 90 g/yr PCBs by 6/30/18,
- 560 g/yr PCBs by 6/30/2020,
- 23 g/yr PCBs using green infrastructure by 6/30/2020, and
- 9 g/yr mercury using green infrastructure by 6/30/2020.

The CCCWP Permittees achieved the required PCBs load reductions in 2018 and 2020, and the PCBs and mercury load reductions using green infrastructure in 2020.

A W/MA is an area where load reduction credit will be sought for PCBs or mercury control measures. The W/MAs cover all Old Industrial and Old Urban areas but may include some New Urban areas where appropriate. W/MAs were delineated using the maps showing the 2015 PCBs source property screening results (i.e. high, moderate, and low/no likelihood), known PCBs source properties (from the CW4CB Task 3 referrals, DTSC EnviroStor, and the State Water Board Geotracker), and land use categories (i.e., Old Industrial, Old Urban, New Urban, Open Space, and Other) from the Mercury and PCBs Control Measures Implementation Status Report (CCCWP, 2016). These factors were used to create approximate delineations based on the geography within each Permittee's jurisdiction. If applicable, a city's General Plan, Specific Plans, and/or Redevelopment Plans were used to form a W/MA boundary. Categorical W/MAs were also created for the non-municipally owned electrical utility (i.e., PG&E) and railroad properties (note, the categorical W/MAs can exist within or create "holes" in the other geographically based W/MAs).

The W/MAs and identified control measures may also evolve over time as the Permittees learn more about these areas through implementation of the control measures. The Permittees may adjust preliminary control measure selections as lessons are learned throughout the permit term.

1.3.3 Roles and Responsibilities for Implementation of Control Measures

Table 1-1 below summarizes, for each control measure, the roles, and responsibilities of the Permittees, CCCWP, and BASMAA. In a general sense, screening/sampling will primarily be conducted by the CCCWP, establishment of regional frameworks will be conducted by BASMAA, and adoption and implementation of control measures will be conducted by the Permittees.

Table 1-1: Control Measure Roles and Responsibilities

Control Measure Category	Roles and Responsibility		
	Permittee	Program	BASMAA
Source Property Identification and Abatement	• Work with Program to design monitoring program. • Prepare referral forms, including identification of enhanced Operation and Maintenance (O&M). • Implement enhanced O&M for referred properties.	• Design and conduct POCs monitoring. • Compile and submit referrals to SFBRWQCB in Region 2 and the CVRWQCB in Region 5. • Coordinate with BASMAA on ongoing control measure adaptive management.	• Discuss ongoing control measure implementation and adaptive management at Monitoring / Pollutants of Concern (MPC) Committee.
Green Infrastructure / Treatment Control Measures	• Prepare a GI Plan. • Implement GI projects. • Gather data on C.3 projects.	• Support GI planning. • Compile data on C.3 projects.	• Coordinate GI planning at Development Committee. • Discuss control measure implementation and adaptive management at MPC Committee.
Managing PCBs in Building Materials	• Participate in BASMAA Regional Project. • Implement PCB in Demolition Program.	• Assist BASMAA Regional Project.	• Develop Framework through Regional Project.
Managing PCBs in Infrastructure	• Participate in BASMAA Regional Project.	• Assist BASMAA Regional Project. • Conduct monitoring.	• Develop monitoring plan and report monitoring results via Regional Project.
Enhanced O&M	• Implement enhanced O&M where identified.	• Coordinate with BASMAA on ongoing control measure adaptive management.	• Discuss ongoing control measure implementation and adaptive management at MPC Committee.
Diversion to POTW	• Implement diversion where identified.	• Coordinate with BASMAA on ongoing control measure adaptive management.	• Discuss ongoing control measure implementation and adaptive management at MPC Committee.
Mercury Load Avoidance and Reduction	• Conduct collection events.	• Compile and track data.	• Discuss ongoing control measure implementation and adaptive management at MPC Committee.
Illegal Dumping Cleanup	• Identify illegal dumping sites. • Conduct/coordinate cleanup.	• Compile and track data.	• Discuss ongoing control measure implementation and adaptive management at MPC Committee.
Stockpiles, Spills, and Disposal of PCBs	• Identify facilities through routine inspections. • Conduct/coordinate cleanup. • Track OES reports and follow-up on spills with PG&E.	• Compile and track data. • Coordinate w/ Permittees, BASMAA partners, SFBRWQCB, and PG&E as needed.	• Discuss ongoing control measure implementation and adaptive management at MPC Committee.

In addition, the Permittees are tracking control measure implementation and reporting load reductions using the GIS C.3 Project Tracking and Load Reduction Accounting Tool, which incorporates the Interim Accounting Methodology to estimate load reductions. This report compiles and reports the county-wide list of green infrastructure projects, site referrals, and overall load reductions as well as the MRP permit area-wide overall load reductions.

Although each Permittee's administrative structure is unique, Table 1-2 summarizes, in general, the roles and responsibilities of the various city, town, or county departments that may be related to implementation of selected control measures:

Table 1-2: Permittee Department Roles and Responsibilities

Department	Typical Role / Responsibility
Public Works	• Creeks, watersheds, and stormwater management • Public facility services and maintenance • Engineering and construction services • Capital improvement projects
Community Development / Planning Department	• Planning/zoning/General Plan development • Development project review & approvals • Construction and building inspections

1.3.4 Load Reduction Methodology

MRP Provisions C.11.a and C.12.a require the Permittees to demonstrate cumulative Bay Area-wide and Program area-specific mercury and PCBs load reductions over the MRP 2.0 permit term. MRP Provisions C.11.b and C.12.b required the Permittees to develop and implement an assessment methodology and data collection program to quantify mercury and PCBs loads reduced through implementation of pollution prevention, source control, and treatment control measures. The Permittees developed an *Interim Accounting Methodology for TMDLs Loads Reduced* report (BASMAA, 2017) to document the load reduction accounting assessment methodology that will be used to demonstrate progress towards achieving the load reductions required in the MRP 2.0 permit term. This report was approved by the SFBRWQCB in May 2017. The Interim Accounting *Methodology* is based on relative mercury and PCBs yields from different land use categories. The method involves using default factors for PCBs and mercury load reduction credits resulting from foreseeable control measures implemented during the MRP 2.0 permit term. This report implements the Interim Accounting System to estimate the mercury and PCBs loads reduced presented in Section 20.

MRP Provisions C.11.b and C.12.b. require the Permittees to submit, in 2018 and subsequent Annual Reports, refinements to the mercury and PCBs load reduction assessment methodology to assess load reductions in the next permit term. Those refinements are documented in the *BASMAA Source Control Load Reduction Accounting for Reasonable Assurance Analysis Report*, which was submitted with the Fiscal Year 2019/20 Annual Report. Comments were received from the Regional Water Board on the report in April 2021. A revised report was approved by the Executive Officer in January 2022. The revised accounting system will be used to estimate the mercury and PCBs load reduced in the next permit term (i.e., beginning in Fiscal Year 2022/23).

2 DESCRIPTION OF CONTROL MEASURES

This section provides a general description of the types of control measures that are currently being implemented or will be implemented by the Permittees during this and future permit terms to control PCBs and mercury.

2.1 Source Property Identification and Abatement

Source property identification and abatement involves investigations of properties located in historically industrial land use or other land use areas where PCBs were used, released, and/or disposed of and where sediment concentrations have been found at levels significantly above urban background levels[4]. The source property identification and abatement control measure begins with performing investigations of these "High Likelihood" areas to identify PCBs sources to the municipal storm drain system. Once a source property is identified, the source of PCBs on the property may be abated or caused to be abated directly by the Permittee or the Permittee may choose to refer the source property to the SFBRWQCB for investigation and abatement by the SFBRWQCB or another appropriate regulatory agency with investigation and cleanup authority. Source properties may include sites that were previously remediated or are currently being remediated but have PCBs soils cleanup levels that are elevated above urban background levels or may be newly identified source properties.

The Permittees will validate the existence of significantly elevated PCBs concentrations through surface soil/sediment sampling in the right-of-way or stormwater sampling in the storm drain system where visual inspections and/or other information suggest that a specific property is a potential source of significantly elevated PCBs concentrations. Where data confirm significantly elevated PCBs concentrations (e.g., a sediment concentration equal to or greater than 1.0 mg/kg or a concentration greater than 0.5 mg/kg plus other lines of evidence) are present in soil/sediment from a potential source property or in stormwater samples, the Permittees will

[4] The *Interim Accounting Methodology for TMDL Loads Reduced* report (BASMAA 2017) presents descriptive statistics for the PCBs and mercury street and storm drain sediment dataset that has been compiled by BASMAA to-date. This dataset includes 1,204 PCBs samples and 952 mercury samples taken within the street right-of-way, storm drain conveyance system, and private properties from 1999 through 2015.

take actions to cause the property to be abated or will refer that property to the SFBRWQCB to facilitate the issuance of orders for further investigation and remediation of the subject property.

For each confirmed source property, the Permittee will implement or cause to be implemented, where appropriate, one or a combination of interim enhanced operation and maintenance (O&M) measures in the street or storm drain infrastructure adjacent to the source property during the source property abatement process to remove historically deposited sediment and/or to prevent further contaminated sediment from entering the storm drain. These enhanced O&M measures will be described in the source property referral that is sent to the SFBRWQCB. If the Permittee finds that enhanced O&M measures are not justified, the Permittee must discuss these findings with the SFBRWQCB prior to submitting the source property referral. The SFBRWQCB will review the source property referral and provide comments to the Permittee within 30 days (if needed).

For those source properties that are self-abated (i.e., by the Permittee or the property owner), the Permittee will provide the Regional Water Board with sufficient documentation that source property abatement has effectively eliminated the transport of PCBs or mercury offsite and from entering the MS4 infrastructure for all transport mechanisms that apply to the site (e.g., stormwater runoff, wind, vehicle tracking). This documentation will include information on the type and extent of abatement that has occurred (e.g., have the sources of PCBs to the MS4 been completely eliminated via capping, paving, walls, plugging/removal of internal storm drains, etc.) and any water or sediment monitoring data that demonstrates the effective elimination of transport of PCBs offsite into the MS4, if available.

The CCCWP, in collaboration with the Permittees, are conducting ongoing targeted investigations and monitoring for known or suspected source properties. Source identification is one of five priority POC management information needs required by MRP provision C.8.f. The allocation of sampling effort for POC monitoring will be described in the POC Monitoring Report, due October 15 of each year, as required by MRP provision C.8.h.iv.

The properties that have been referred to the SFBRWQCB or self-abated through FY 2021/22 are listed in Table 2-1 below. No new site referrals are included for this fiscal year.

Table 2-1: CCCWP Contaminated Sites Referred to the SFBRWQCB and Self-Abated Properties

SITE NAME	LOCATION/APN	PROPERTY SIZE (ACRES)	YEAR REFERRED	REFERRAL OR SELF-ABATEMENT
Zeneca/Former Stauffer Chemical Company	1415 South 47th St, Richmond	9.2	FY2019/20	Referral
UC Berkeley Richmond Field Station	1301 South 46th St, Richmond	14	FY2019/20	Referral
Fass Metals	818 West Gertrude Ave, Richmond	0.2	FY2017/18	Referral
Sims Metal Management Richmond Facility	600 South 4th Street, Richmond / 560-240-040, 560-250-027, 560-250-025	19.3	FY 2017/18	Referral
World Corp	1014 Chesley Ave., Richmond	10.44	FY 2017/18	Referral
Port of Richmond	Point Potrero Marine Terminal, Richmond	0.72	FY 2017/18	Self-Abatement
San Diego St. Transformer Spill	R.O.W. San Diego St., Richmond	0.08	FY 2017/18	Self-Abatement
Larkey Pool Renovation Project	2771 Buena Vista Ave., Walnut Creek/171-110-021	<0.01	FY 2017/18	Self-Abatement
Radiant Avenue	Radiant Avenue, North Richmond; 408-082-030	19.5	FY 2016/17	Self-Abatement
Former Molino Enterprises. Inc.	1215 Willow Pass Rd., Pittsburg; 096-091-003-2	6.0	FY 2015/16	Referral
Rumrill Sports Complex (Former BNSF Railyard Site)	1509 Rumrill Blvd, San Pablo / 409-313-009; 409-313-009; 410-012-007; 410-012-008	4.45	FY 2015/16	Self-Abatement

2.2 Green Infrastructure / Treatment Control Measures

This control measure includes new development and redevelopment projects on private and public properties regulated by Provision C.3, as well as retrofit of existing infrastructure in public ROW areas and on public properties not subject to Provision C.3. See Section 3 of the Contra Costa Clean Water Program Fiscal Year 2021/22 Annual Report for further detail on C.3 implementation.

Permittees are accounting for implemented C.3. projects and public retrofit GI projects over the MRP 2.0 permit term to achieve the PCBs load reductions shown in MRP Table 12.2 and mercury load reductions shown in MRP Table 11.1. Permittees are identifying existing C.3 projects as part of this control measure and, in compliance with the requirement of MRP Provision C.3.b.i.(2), will be tracking development projects that are subject to C.3. over the MRP 2.0 permit term.

In addition, the Permittees have been conducting an ongoing review of opportunities for incorporating GI into existing and planned capital improvement projects over the MRP 2.0 permit term (a.k.a., no missed opportunities) and have developed a GI Plan for the inclusion of low impact development drainage design into storm drain infrastructure on public and private lands, including streets, roads, storm drains, parking lots, building roofs, and other storm drain infrastructure elements, in compliance with MRP Provision C.3.j.

2.3 Managing PCBs In Building Materials and Infrastructure

2.3.1 PCBs in Building Materials

The Permittees have developed and implemented, in cooperation with BASMAA, a protocol for managing materials with PCBs concentrations of 50 ppm or greater in applicable structures at the time such structures undergo demolition. PCBs from these structures can enter storm drains during and/or after demolition through vehicle track-out, airborne releases, soil erosion, stormwater runoff, or improper waste disposal. Applicable structures include, at a minimum, commercial, public, institutional, and industrial structures constructed between the years 1950 and 1980 and with building materials with PCBs concentrations of 50 ppm or greater. Single-family residential and wood frame structures are exempt. A Permittee is exempt from this requirement if the only structures that existed pre-1980 within its jurisdiction were single-family residential and/or wood-frame structures[5].

The Program and Permittees participated in a BASMAA Regional Project to address PCBs in building materials. This Regional Project developed an implementation framework, guidance

[5] Each Permittee seeking exemption from C.12.f requirements must submit in its 2017 Annual Report documentation, such as historic maps or other historic records, that clearly demonstrates that the only structures that existed pre-1980 within its jurisdiction were single-family residential and/or wood-frame structures. The City of Clayton has been approved for this exemption and documentation was included in its 2017 Annual Report.

materials, and tools for local agencies to ensure that PCBs-containing materials and wastes are properly managed during building demolition. This Regional Project also provided training materials and a workshop for municipal staff and an outreach workshop for the industry on implementing the framework/protocols developed via the project. The tools and materials developed as part of the project build upon materials and outputs developed in 2010-2011 by the San Francisco Estuary Partnership with State Water Board grant funding, called the “PCBs in Caulk Project”, as well as subsequent and parallel activities by BASMAA. See Section 12 of the Contra Costa Clean Water Program Fiscal Year 2020/21 Annual Report for further details on compliance with this MRP provision. Specific activities undertaken by the Permittees are discussed in the Permittee-specific sections of this report.

In addition, BASMAA has developed an assessment methodology and data collection program to quantify the PCBs loads reduced through implementation of the protocol developed by the BASMAA Regional Project, summarized below:

1. The municipality informs demolition permit applicants that their projects are subject to the MRP Provision C.12.f requirements, necessitating, at a minimum, an initial screening for priority PCBs–containing materials.
2. For every demolition project, applicants complete and submit a version of BASMAA’s model “PCBs Screening Assessment Form” (Screening Form) or equivalent to the municipality.
3. The municipality reviews the Screening Form to make sure it is filled out correctly and is complete and works with the applicant to correct any deficiencies.
4. The municipality then issues the demolition permit or equivalent, according to its procedures.
5. The countywide programs compile the completed Screening Forms and any supporting documents. Municipalities submit forms for applicable structures only to the countywide program; forms for exempt sites need not be submitted. The countywide program compiles the forms and works with the other MRP countywide programs to manage and evaluate the data, and to assist Permittees with associated MRP reporting requirements.

Data collection started with implementation of the new program on July 1, 2019. When sufficient amounts of new data have been collected, the data will support:

- Development of a revised estimate of the reduction in PCBs loading to stormwater runoff resulting from implementation of the new program, and
- Evaluation of various aspects of the PCBs management program and the effectiveness of potential future refinements.

2.3.2 PCBs in Infrastructure

PCBs may also be found in storm drain or roadway infrastructure in public rights-of-way such as caulk and sealants used in storm drains and between concrete curbs and street pavement. The Program and Permittees participated in a BASMAA Regional Project to characterize the levels of PCBs in caulks/sealants used in storm drains and roadway infrastructure to quantify the potential PCBs load reduction benefits that may result from public infrastructure improvements. A project report prepared by the BASMAA Regional Project was included in the Contra Costa Clean Water Program Fiscal Year 2017/18 Annual Report. The results of these investigations will inform the development and implementation of control measures to address this potential source of PCBs into the storm drain system.

2.4 Enhanced Operation and Maintenance

Routine MS4 O&M activities include street sweeping, drain inlet cleaning, and pump station maintenance. In addition, culverts and channels are also routinely maintained (i.e., desilted). Enhancements to routine operations and new actions such as storm drain line and street flushing may enhance the Permittees' ability to reduce PCBs and mercury in stormwater. PCBs load reductions achieved through implementation of enhanced O&M control measures, aside from enhanced O&M control measures associated with source property referrals, may be counted as part of the overall load reductions during the MRP 2.0 permit term.

Many of the Permittees have installed inlet-based full trash capture devices in response to the trash control requirements of MRP Provision C.10. These devices enhance the capture of sediments that may be contaminated with PCBs. In addition, these inlets are typically cleaned more frequently as a result of the installation of the full trash capture device. Therefore, the Permittees are conducting an enhanced O&M activity for each of these inlets. The load reduction achieved by this enhanced O&M implementation effort[6] was estimated in the FY 2017/18 annual report. This estimate does not reflect any increases in enhanced O&M efforts in FY 2021/22.

The following assumptions were used for calculating the reported loads reduced by enhanced O&M control measures:

- Inlet-Based Trash Devices Cleaning
    - Basket, connector pipe screen (CPS), and inlet filters that are listed in the AGOL system were included. The drainage area listed for each device was used for the load reduction calculation. Only operational devices installed since FY 2013-14 were included.
    - The default trash device cleanout frequency enhancement was from annual to semi-annual, as this cleanout frequency is required by MRP Provision C.10, unless a more frequent frequency was reported by the Permittee (or no enhancement was reported).
    - If cleanout occurs three times per year, a 'quarterly' frequency was assumed for the purposes of the calculation, as three times per year is not a viable calculation option per the Interim Accounting Methodology. This assumption was assumed to be equivalent to quarterly cleanouts, as a mid-dry season cleanout occurrence is considered superfluous for the purposes of sediment removal.
- Street Sweeping Enhanced O&M

  One permittee, Concord, has enhanced their sweeping from None to Annually. However, an annual street sweeping frequency is not an enhancement option in the Interim Accounting Methodology. In order to consider this enhancement, the calculation used the least frequent sweeping option, Monthly, and scaled this load reduction linearly to Annual by dividing the estimated load reduced by 12.6

[6] The load reduction estimates account only for the change in inlet cleaning frequency, per the Interim Accounting Methodology, and do not estimate loads reduced due to the increase in sediment captured by the inlet-based full trash capture devices.

- Desilting

  Permittees have conducted some desilting; however, the data needed to estimate loads reduced are difficult to collect for these projects. Therefore, there was no desilting load reduction included in the estimate.

2.5 Diversion to POTW

This control measure consists of diverting dry weather and/or first flush events from MS4s to publicly owned treatment works (POTWs) as a method to reduce loads of PCBs and mercury in urban runoff. A pilot diversion project was conducted at the North Richmond Pump Station, but there is no ongoing diversion.

2.6 Source Controls and Other Control Measures

2.6.1 Mercury Load Avoidance and Reduction

Mercury load avoidance and reduction includes a number of source control measures listed in the California Mercury Reduction Act adopted by the State of California in 2001. These source controls include material bans, reductions of the amount of mercury allowable for use in products, and mercury device recycling. The following source controls bans are included:

- Sale of cars that have light switches containing mercury;
- Sale or distribution of fever thermometers containing mercury without a prescription;
- Sale of mercury thermostats; and,
- Manufacturing, sale, or distribution of mercury-added novelty items.

In addition, fluorescent lamps manufacturers continue to reduce the amount of mercury in lamps sold in the U.S. Manufacturers have significantly reduced the amount of mercury in fluorescent linear tube lamps.

Mercury Device Recycling Programs resulting in Mercury load reduction generally include three types of programs that promote and facilitate the collection and recycling of mercury–containing devices and products:

- Permittee-managed household hazardous waste (HHW) drop-off facilities and curbside or door-to-door pickup;

- Private business take-back and recycling programs (e.g., Home Depot); and,
- Private waste management services for small and large businesses.

The Program conducted a Methylmercury Control Study in response to Provision C.11.i of the East County Permit[7], which states: “Permittees shall conduct methylmercury control studies to monitor and evaluate the effectiveness of existing BMPs on the control of methylmercury and shall develop and evaluate additional BMPs as needed to reduce mercury and methylmercury discharges to the Delta and meet methylmercury waste load allocations…”. The Methylmercury Control Study Final Report was submitted to the Central Valley Regional Water Board in October 2018[8]. CCCWP conducted reasonable potential analyses (i.e., RAA modeling) and submitted preliminary results to the CVRWQCB in March 2022.

The Program coordinates with Permittees and local household hazardous waste (HHW) collection facilities to implement mercury collection and recycling in accordance with MRP Provisions C.11.a.i and C.11.a.ii.

CCCWP Permittees collect HHW at three regional facilities in the County:

- Central Contra Costa Sanitary District (CCCSD);
- Delta Diablo Sanitation District (DDSD); and,
- West Contra Costa Integrated Waste Management District (WCCIWMA).

CCCSD serves the communities of Concord, Clayton, Martinez, Pleasant Hill, Orinda, Lafayette, Moraga, Walnut Creek, Danville, San Ramon, and Unincorporated County. DDSD serves Pittsburg, Antioch, Oakley, and Bay Point. WCCIWMA serves Richmond, Pinole, El Sobrante, El Cerrito, San Pablo, and portions of Unincorporated Contra Costa County.

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[7] East Contra Costa County Municipal NPDES Permit (NPDES Permit No. CAS083313, Order No. R5-2010-0102).

[8] This report can be found on the CCCWP website at: https://www.cccleanwater.org/userfiles/kcfinder/files/Methlymercury_Control_Studies_Progress_Report_FINAL_Oct2015%281%29.pdf.

The types of data collected at each facility are slightly different as is the level of differentiation between types of mercury containing devices and the level of specificity in reporting the data. These efforts are no longer required to be reported but will be tracked for mercury loads reduced through implementation of mercury avoidance and reduction control measures.

In addition, Table 2-2 below lists some mercury spill response efforts in Contra Costa County.

Table 2-2: Mercury Spills in Contra Costa County

SPILL DATE	CITY	LOCATION	INCIDENT TYPE	QUANTITY/ CONCENTRATION	DATE OF FINAL SPILL REPORT
3/13/2017	Antioch	2209 Manzanita Dr	Spill	5-gal(s) Mercury	3/13/2017
3/7/2017	Rossmoor	3324 Tice Creek Dr. Apt. 11	Spill	"a few" ml/g of Mercury spilled	3/10/2017
1/22/2017	Antioch	2206 Mandarin Way	Spill	Small Unk Mercury amount	1/26/2017
12/22/2016	Antioch	2324 Mandarin Way	Spill	1 oz Mercury	12/22/2016

2.6.2 Illegal Dumping Clean-Up

This source control measure entails clean-up of construction and demolition debris from illegal dumping areas that contain PCBs. This control measure will apply to construction and demolition illegal dumping only during the MRP 2.0 permit term but may be expanded to other types of illegally dumped trash if supported by monitoring data.

2.6.3 Stockpile, Spills, and Disposal of PCBs

This control measure includes the proper clean-up and disposal of stockpiles, spills, and/or improperly disposed quantities of PCBs. The measure would involve, for instance, a concentrated source of PCBs (e.g., a barrel) that is found leaking and cleaned-up or properly disposed and the clean-up of transformer spills by PG&E.

CCCWP and BASMAA representatives have been working with SFBRWQCB staff to ensure thorough documentation and clean-up completion of PG&E PCBs transformer spills. PCBs transformer spill reporting is inconsistent through the OES reporting system and often cases are closed before the municipality or SFBRWQCB staff hear of the spill. This activity could have a significant effect on where PCBs in the public right-of-way are found, as many spills happen in residential areas. Residential areas are not typically considered high likelihood areas for PCBs, so no other control measures have been developed specifically for these areas. SFBRWQCB and BASMAA representatives are working on better defining agency roles and responsibilities in responding to spills, at least for their own agencies, and are working on getting PG&E to cooperate to make a smoother and more transparent process as we try to reduce the loading of PCBs into the San Francisco Bay, San Joaquin/Sacramento Rivers Delta, and Suisun and San Pablo Bays.

CCCWP staff has been compiling information on PCBs transformer spills that have occurred since 2014 (there are additional data from earlier years). Table 2-3 presents a partial list of the spills that have happened throughout Contra Costa County from November 2014 – May 2019. All information on the spills and clean-ups are not currently available, as the process to get documentation of the completion of a clean-up is difficult. PG&E has many private contractors that are called out at odd hours in all types of weather to do the clean-up. Locating one representative who can confirm PG&E's process or progress on spills has proven impossible. Many spills are less than 49 gallons and less than 50 ppm, but still have significant levels of PCBs concentrations (e.g., 5 gallons of transformer oil with a PCBs concentration of 44 ppm).

BASMAA conducted a regional Stressor/Source Identification (SSID) project, in compliance with MRP Provision C.8.e, that developed a regional SSID workplan to further understand the magnitude and extent of PCBs released by electrical utility equipment spills, and to identify controls that could be implemented to reduce the water quality impacts of this source. In FY 2018-19, the regional SSID project developed the SSID workplan. As a result of this project, BASMAA sent a letter to the SFBRWQCB requesting that the Regional Water Board use its authority under Section 13267 of the California Water Code to compel private electrical utilities operating in the Bay Region to provide technical information that is needed to support further investigation of electrical utility equipment and properties as potential sources of PCBs to MS4s in the Bay Region.

Table 2-3: PG&E Transformer Pole Spills in Contra Costa County

SPILL DATE	CITY	LOCATION	INCIDENT TYPE	QUANTITY/ CONCENTRATION	DATE OF FINAL SPILL REPORT FROM PGE AND SFBRWQCB
5/3/2019	El Sobrante	711 Alhambra Road	Spill	5-gals PCB Mineral Oil 103 ppm	Not determined
1/31/2018	Richmond	600 South 4th Street	Fire/Explosion		2/12/2018
1/9/2018	Concord	2395 Willow Pass Rd.	Spill	50 gal(s) Non-PCB Insulating Oil	1/9/2018
Not determined	Richmond	665 S 31st St.	Storm Drain/Creek	120-gal(s) Petroleum Mineral oil (non-PCB)	10/3/2017
6/26/2017	El Cerrito	984 King Ave	Spill	3-gal, unknown concentration PCBs	Not determined
6/26/2017	El Cerrito	984 King Ave	Spill	3-gal(s) Transformer oil 9.5 ppm	6/27/2017
6/23/2017	Richmond	4480 Bell Ave.	Spill	5-gal(s) Petroleum Mineral oil (Unknown PCB)	6/24/2017
6/5/2017	Richmond	4949 Cypress Ave	Spill	1 gal(s) Petroleum Mineral oil (non-PCB)	6/6/2017
6/3/2017	Pittsburg	493 Rich Spring Dr.	Spill	3 gal(s) Non-PCB Mineral Oil	6/6/2017
5/9/2017	Danville	134 Verde Mesa Drive	Spill	20 gal(s) Mineral Oil (Unknown PCB)	5/9/2017
4/9/2017	Pinole	2621 Appian Way	Spill	180 gal(s) Mineral Oil (non-PCB)	4/9/2017
4/6/2017	Richmond	1100 S 27th St.	Spill	1 gal, 25 PPM PCBs	Not determined
4/5/2017	Richmond	209 Parr Blvd	Spill	1 gal(s) Petroleum Mineral oil (25 ppm PCB)	4/6/2017
1/12/2017	Lafayette	3584 Mt. Diablo Blvd	Spill	10-gal(s) Transformer Oil (Unknown PCB)	1/14/2017
11/19/2016	Pleasant Hill	624 Contra Costa Blvd.	Spill	50 gal	Not determined
11/10/2016	Moraga	806 Crossbrook Dr	Spill	5-gal, 280 ppm PCBs	Not determined
10/21/2016	Alamo	Corner of Danville Blvd x Stone Valley Road	Spill	5 gal	Not determined
8/31/2016	Concord	1494 Washington Blvd	Spill	42,658 gal	Not determined

SPILL DATE	CITY	LOCATION	INCIDENT TYPE	QUANTITY/ CONCENTRATION	DATE OF FINAL SPILL REPORT FROM PGE AND SFBRWQCB
6/12/2016	Discovery Bay	2426 Pinehurst Ct.	Spill	1 gal, unknown PCBs	Not determined
4/5/2016	Orinda	Orinda	Spill	20-gal, undefined conc.	Not determined
3/6/2016	Concord	1354 Babel Ln, Concord	Spill	30-gal, 31 ppm (reported to OES as 1,000 ppm)	Not determined
2/7/2016	Richmond	5610 Bayview, Richmond	Spill	13 gal, <2 ppm	3/2/2016
5/4/2015	Richmond	5635 San Diego St, Richmond	Spill	60-gal, 45 ppm	11/16/2015
11/14/2014	Richmond	Port of Richmond	Spill	48,303 kg, 600,000 mg/kg	Early 2016

3 CITY OF CLAYTON

3.1 List of Watersheds / Management Areas and Control Measures

The watersheds / management areas (W/MAs) the City of Clayton are listed in Table 3-1 below.

Table 3-1: **City of Clayton PCBs and Mercury Watershed Management Areas (W/MAs) and Associated Land Uses**

W/MA Identifier	Total Area[1] (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
CLA-1: Old Urban	738.1	0	100.0	0	0	0

Notes:

1. Land use breakdown as of IMR land use year 2013.

The control measures that are currently being implemented during the term of the permit in each of these W/MAs are summarized in Table 3-2 and are described in the sections below.

Table 3-2: City of Clayton Area Treated by Area-Based Control Measure Category (FY 2013/14 through FY 2021/22)

Control Measure Category	Total Area Treated (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
Green Infrastructure and Treatment	23.5	0	55.7	44.3	0	0
Large Full Trash Capture Devices	0	0	0	0	0	0
Enhanced O&M Measures[1]	167.9	0	5.3	46.9	47.8	0

Notes: Control measure implementation data may be incomplete for FY 2021/22.

1. Includes inlet-based full trash capture device clean out.

3.2 Scope and Schedule of PCBs Control Measures

3.2.1 Source Property Identification and Abatement

PCBs-Contaminated Properties Referred to the Regional Water Board

No properties within the City of Clayton have been referred to the SFBRWQCB as a result of implementation of the Source Property Identification and Abatement control measure to date.

Ongoing Investigations

No further investigation is warranted in the City of Clayton.

3.2.2 Green Infrastructure / Treatment Control Measures

Any development, redevelopment, and infrastructure projects within the W/MA will be subject to the development standards in effect at the time an application is made, such as applicable provisions of MRP section C.3. See the City of Clayton's Green Infrastructure Plan for further information.

3.2.3 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

The City of Clayton has been approved for exemption pursuant to C.12.f.i and C.12.f iii.

Managing PCBs in Infrastructure

The Program and Permittees participated in a BASMAA Regional Project to address PCBs in infrastructure as described in Section 2.3.2.

3.2.4 Enhanced Operation and Maintenance Control Measures

Enhanced O&M control measures that have been implemented by the City of Clayton include clean out of inlet-based full trash capture devices on a semi-annual basis.

3.2.5 Diversion to POTW

No diversion to POTW control measures are proposed.

3.2.6 Source Controls and Other Control Measures

Mercury Load Avoidance and Reduction

The Permittees are actively implementing mercury recycling programs in all W/MAs in order to reduce mercury loading to the San Francisco Bay, San Joaquin/Sacramento Rivers Delta, and Suisun and San Pablo Bays.

Illegal Dumping Cleanup

The Permittees will identify and cleanup illegal dumping of construction and demolition debris where illegal dumping of construction and demolition debris occurs.

Stockpiles, Spills, and Disposal of PCBs

Stockpiles and spills of PCBs will be addressed as they are identified through industrial facility inspection and spill notification programs.

4 CITY OF CONCORD

4.1 List of Watersheds / Management Areas and Control Measures

The W/MAs within the City of Concord are listed in Table 4-1 below.

Table 4-1: City of Concord PCBs and Mercury Watershed Management Areas (W/MAs) and Associated Land Uses

W/MA Identifier	Total Area[1] (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
CON-1: Old Urban	13,047.7	0.1	76.8	6.6	16.2	0.3
CON-2: Old Industrial	1,073.1	19.2	20.5	47.8	12.4	0
CON-3: Military Base	5,344.7	0	1.0	0	5.1	93.9
CON-PGE: Categorical PG&E	21.9	0.9	92.4	0.3	6.4	0
CON-RAIL: Categorical Railroad	49.6	30.6	12.0	1.5	55.9	0

Notes:

1. Land use breakdown as of IMR land use year 2013.

The control measures that are currently being implemented in each of these W/MAs are summarized in Table 4-2 and are described in the sections below.

Table 4-2: City of Concord Area Treated by Area-Based Control Measure Category (FY 2013/14 through FY 2021/22)

Control Measure Category	Total Area Treated (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
Green Infrastructure and Treatment	129.9	8.5	66.4	9.2	16.0	0
Large Full Trash Capture Devices	0	0	0	0	0	0
Enhanced O&M Measures[1]	1,335.0	1.6	91.2	4.9	2.1	0.2

Notes:

1. Includes enhanced street sweeping and inlet-based full trash capture device clean out.

4.2 Scope and Schedule of PCBs Control Measures

4.2.1 Source Property Identification and Abatement

PCBs-Contaminated Properties Referred to the Regional Water Board

No properties within the City of Concord have been referred to the SFBRWQCB as a result of implementation of the Source Property Identification and Abatement control measure to date.

Ongoing Investigations

Ongoing investigations may result in a property referral in the future.

4.2.2 Green Infrastructure / Treatment Control Measures

Any development, redevelopment, and infrastructure projects within each of the W/MAs will be subject to the development standards in effect at the time an application is made, such as demolition standards and applicable provisions of MRP section C.3. See the City of Concord's Green Infrastructure Plan for further information.

4.2.3 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

As part of the demolition for the planned Veranda shopping center project, the building materials and surrounding onsite soils for the existing Chevron offices on Diamond Boulevard were tested and materials identified as below the residential numeric detection limits for PCBs (<0.25 ppm), per EPA guidance, were designated for haul away and disposal at an approved site, thereby mitigating a measured volume of PCBs that otherwise had the potential to migrate into downstream receiving waters.

The Program and Permittees participated in the BASMAA Regional Project to address PCBs in building materials as described in Section 2.3.1. The City of Concord was actively involved in the region-wide discussions and development of the program to reduce the migration of PCBs during building demolition through participation on the Regional Project Technical Advisory Committee. The City began implementing the program on July 1, 2019.

Managing PCBs in Infrastructure

The Program and Permittees participated in a BASMAA Regional Project to address PCBs in infrastructure as described in Section 2.3.2.

4.2.4 Enhanced Operation and Maintenance Control Measures

Enhanced O&M control measures that have been implemented by the City of Concord include clean out of inlet-based full trash capture devices on a semi-annual basis. In addition, the City of Concord Public Works department has implemented an enhanced street sweeping program. Numerous streets that historically had limited access for street sweeping due to parked cars are being posted “no parking” so that they can be swept clean. This enhanced maintenance activity is happening annually. The effort involves extensive public notifications, placing over 150 barricades, trimming trees, re-painting red-curbs, and towing vehicles that remain on the street. The list of locations is provided below.

- Carey Drive; from Monument Boulevard to Victory Lane
- Frisbi Court; from Lacey Lane to the end of the street
- Virginia Lane; from Monument Boulevard to Premier Place
- Oakmead Drive; from Monument Boulevard to Toyon Drive
- Laguna Street; from Amador Drive to Detroit Avenue
- Victory Lane; from Monument Boulevard to Linden Drive
- Robin Lane; from Virginia Lane to Meadow Lane
- Toyon Drive; from Oakmead Drive to Ellis Street
- Riley Court; from Meadow Lane to the end of the street
- Reganti Place; from Reganti Drive to the end of the street
- Lacey Lane; from Monument Boulevard to Tilson Drive
- Ellis Street; from Toyon Drive to Clayton Road
- Sierra Road; from Oak Grove Road to Fox Meadow Way
- Pine Street; from Clayton Road to the end of the Street
- Toyon Oakmead to Oakmead

- San Miguel Cowell to Via Montanas

4.2.5 Diversion to POTW

No diversion to POTW control measures are proposed.

4.2.6 Source Controls and Other Control Measures

Mercury Load Avoidance and Reduction

The Permittees are actively implementing mercury recycling programs in all W/MAs in order to reduce mercury loading to the San Francisco Bay, San Joaquin/Sacramento Rivers Delta, and Suisun and San Pablo Bays.

Illegal Dumping Cleanup

The Permittees does identify and cleanup illegal dumping of construction and demolition debris where illegal dumping of construction and demolition debris occurs.

Stockpiles, Spills, and Disposal of PCBs

Stockpiles and spills of PCBs are addressed as they are identified through industrial facility inspection and spill notification programs.

5 TOWN OF DANVILLE

5.1 List of Watersheds / Management Areas and Control Measures

The W/MAs within the Town of Danville are listed in Table 5-1 below.

Table 5-1: Town of Danville PCBs and Mercury Watershed Management Areas (W/MAs) and Associated Land Uses

W/MA Identifier	Total Area[1] (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
DAN-1: Danville Town Boundary	11,554.2	0.1	38.9	21.5	39.6	0
DAN-PGE: Categorical PG&E	14.4	0	75.1	24.9	0	0

Notes:

1. Land use breakdown as of IMR land use year 2013.

The majority of the Town is residential with a lot of preserved open space areas and hillsides. Old Urban commercial uses are concentrated in the old downtown area on Hartz Avenue and along San Ramon Valley Boulevard. A portion of the older residential areas are also identified as old urban.

The control measures that are currently being implemented during the term of the permit in each of these W/MAs are summarized in Table 5-2 and are described in the sections below.

Table 5-2: Town of Danville Area Treated by Area-Based Control Measure Category (FY 2013/14 through FY 2021/22)

Control Measure Category	Total Area Treated (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
Green Infrastructure and Treatment	598.2	0	7.1	2.9	90.0	0.
Large Full Trash Capture Devices	0	0	0	0	0	0
Enhanced O&M Measures[1]	112.2	0	96.5	2.7	0.8	0

Notes:

1. Includes inlet-based full trash capture device clean out.

5.2 Scope and Schedule of PCBs Control Measures

5.2.1 Source Property Identification and Abatement

PCBs-Contaminated Properties Referred to the Regional Water Board

Danville has no known or suspected source properties. No properties within the Town of Danville have been referred to the SFBRWQCB as a result of implementation of the Source Property Identification and Abatement control measure to date.

Ongoing Investigations

No further investigation is warranted in the Town of Danville.

5.2.2 Green Infrastructure / Treatment Control Measures

All redevelopment in Danville will be subject to C.3 regulations. See the Town of Danville's Green Infrastructure Plan for further information.

5.2.3 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

The Program and Permittees participated in the BASMAA Regional Project to address PCBs in building materials as described in Section 2.3.1. Danville began implementation of the program on July 1, 2019.

Managing PCBs in Infrastructure

The Program and Permittees participated in a BASMAA Regional Project to address PCBs in infrastructure as described in Section 2.3.2.

5.2.4 Enhanced Operation and Maintenance Control Measures

Enhanced O&M control measures that have been implemented by the Town of Danville include clean out of inlet-based full trash capture devices on a semi-annual basis.

5.2.5 Diversion to POTW

No diversion to POTW control measures are proposed.

5.2.6 Source Controls and Other Control Measures

Mercury Load Avoidance and Reduction

The Permittees are actively implementing mercury recycling programs in all W/MAs in order to reduce mercury loading to the San Francisco Bay, San Joaquin/Sacramento Rivers Delta, and Suisun and San Pablo Bays.

Illegal Dumping Cleanup

The Town of Danville regularly identifies and cleans up illegal dumping throughout town, including construction and demolition debris.

Stockpiles, Spills, and Disposal of PCBs

Stockpiles and spills of PCBs will be addressed as they are identified through the Town's established industrial facility inspection and spill notification programs.

6 CITY OF EL CERRITO

6.1 List of Watersheds / Management Areas and Control Measures

The W/MAs within the City of El Cerrito are listed in Table 6-1 below.

Table 6-1: City of El Cerrito PCBs and Mercury Watershed Management Areas (W/MAs) and Associated Land Uses

W/MA Identifier	Total Area[1] (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
ELC-1: Old Urban	2,023.2	0	98.0	0.4	1.5	0
ELC-2: Old Industrial and High Likelihood	0.7	73.5	2.7	0	23.7	0
ELC- PGE: Categorical PG&E	29.9	26.4	38.8	0.1	34.7	0
ELC- RAIL: Categorical Railroad	9.4	0	100.0	0	0	0

Notes:

1. Land use breakdown as of IMR land use year 2013.

The control measures that are currently being implemented during the term of the permit in each of these W/MAs are summarized in Table 6-2 and are described in the sections below.

Table 6-2: City of El Cerrito Area Treated by Area-Based Control Measure Category (FY 2013/14 through FY 2021/22)

Control Measure Category	Total Area Treated (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
Green Infrastructure and Treatment	14.6	1.4	91.1	2.7	4.8	0
Large Full Trash Capture Devices	0	0	0	0	0	0
Enhanced O&M Measures[1]	417.3	0.2	95.9	2.7	1.2	0

Notes:

1. Includes inlet-based full trash capture device clean out.

6.2 Scope and Schedule of PCBs Control Measures

6.2.1 Source Property Identification and Abatement

PCBs-Contaminated Properties Referred to the Regional Water Board

No properties within the City of El Cerrito have been referred to the SFBRWQCB as a result of implementation of the Source Property Identification and Abatement control measure to date.

Ongoing Investigations

Ongoing investigations may result in a property referral in the future.

6.2.2 Green Infrastructure / Treatment Control Measures

Any development, redevelopment, and infrastructure projects within each of the W/MAs will be subject to the development standards in effect at the time an application is made, such as demolition standards and applicable provisions of Section C.3. See the City of El Cerrito's Green Infrastructure Plan for further information.

6.2.3 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

The City of El Cerrito participated in the BASMAA Regional Project to address PCBs in building materials as described in Section 2.3.1. The City of El Cerrito began implementation of the program on July 1, 2019.

Managing PCBs in Infrastructure

The Program and Permittees participated in a BASMAA Regional Project to address PCBs in infrastructure as described in Section 2.3.2.

6.2.4 Enhanced Operation and Maintenance Control Measures

Enhanced O&M control measures that have been implemented by the City of El Cerrito include clean out of inlet-based full trash capture devices on a semi-annual basis.

6.2.5 Diversion to POTW

No diversion to POTW control measures are proposed.

6.2.6 Source Controls and Other Control Measures

Mercury Load Avoidance and Reduction

The City of El Cerrito has partnered with RecycleMore to offer Household Hazardous Waste (HHW) Collection at an additional site, located at the El Cerrito Recycling Center. This service provides residents in the City of El Cerrito with an even more convenient location for disposing of materials containing HHW, including products that contain mercury. El Cerrito, along with other permittees, is also actively implementing mercury recycling programs in all W/MAs in order to reduce mercury loading to the Bay and Delta.

Illegal Dumping Cleanup

The City of El Cerrito Public Works department actively works to identify and cleanup illegal dumping of construction and demolition debris where illegal dumping of construction and demolition debris occurs. Public Works Staff respond whenever an illegal dumping complaint is received, in addition to completing weekly inspections and cleanups throughout the community.

Stockpiles, Spills, and Disposal of PCBs

El Cerrito has done significant outreach to educate the public that only rain should enter creeks and storm drains. This has included featuring related articles in the City's "News & Views" newsletter, the City's "Greener El Cerrito" newsletter, and in the City's "Green Happenings" e-newsletter. City staff also provided outreach materials at events such as the City's 4th of July Festival and Earth Day in 2018. Through these outreach methods, the City has actively encouraged residents to report spills and illicit discharges and to properly dispose of Household Hazardous Waste. Stockpiles and spills of PCBs are addressed as they are identified through industrial facility inspection and spill notification programs.

The City of El Cerrito's Public Works staff responds to reports of spills and discharges as soon as possible by containing spills and vacuuming or diverting spills away from the MS4 to a permeable landscape. Staff normally investigates the complaint on the same business day. In cases where the complaint is received after business hours, staff is dispatched as an emergency through the

El Cerrito Police Department, at which time the after-hours crew responds, contains, or diverts and investigates.

7 CITY OF HERCULES

7.1 List of Watersheds / Management Areas and Control Measures

The W/MAs within the City of Hercules are listed in Table 7-1 below.

Table 7-1: City of Hercules PCBs and Mercury Watershed Management Areas (W/MAs) and Associated Land Uses

W/MA Identifier	Total Area[1] (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
HER-1: Old Urban	479.9	23.9	44.3	20.0	11.7	0
HER-2: Old Industrial/ High Likelihood	64.3	51.6	18.7	10.0	19.7	0
HER-PGE: Categorical PG&E	2.4	29.0	59.6	11.5	0	0
HER-RAIL: Categorical Railroad	26.1	88.5	0.5	0	10.9	0

Notes:

1. Land use breakdown as of IMR land use year 2013.

The control measures that are currently being implemented during the term of the permit in each of these W/MAs are summarized in Table 7-2 and are described in the sections below.

Table 7-2: City of Hercules Area Treated by Area-Based Control Measure Category (FY 2013/14 through FY 2021/22)

Control Measure Category	Total Area Treated (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
Green Infrastructure and Treatment	52.1	21.5	0	0.6	77.9	0
Large Full Trash Capture Devices	286.0	18.4	21.1	48.1	12.4	0
Enhanced O&M Measures[1]	72.4	0.1	0.1	96.1	3.6	0

1. Notes: Control measure implementation data may be incomplete for FY 2021/22.Includes inlet-based full trash capture device clean out.

7.2 Scope and Schedule of PCBs Control Measures

7.2.1 Source Property Identification and Abatement

PCBs-Contaminated Properties Referred to the Regional Water Board

No properties within the City of Hercules have been referred to the SFBRWQCB as a result of implementation of the Source Property Identification and Abatement control measure to date.

Ongoing Investigations

Ongoing investigations may result in a property referral in the future.

7.2.2 Green Infrastructure / Treatment Control Measures

Any development, redevelopment, and infrastructure projects within each of the W/MAs will be subject to the development standards in effect at the time an application is made, such as demolition standards and applicable provisions of section C.3. See the City of Hercules' Green Infrastructure Plan for further information.

7.2.3 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

The Program and Permittees are actively participating in a BASMAA Regional Project to address PCBs in building materials as described in Section 2.3.1. Hercules began implementation of the program on July 1, 2019.

Managing PCBs in Infrastructure

The Program and Permittees participated in a BASMAA Regional Project to address PCBs in infrastructure as described in Section 2.3.2.

7.2.4 Enhanced Operation and Maintenance Control Measures

Enhanced O&M control measures that have been implemented by the City of Hercules include clean out of inlet-based full trash capture devices on a semi-annual basis.

7.2.5 Diversion to POTW

No diversion to POTW control measures are proposed.

7.2.6 Source Controls and Other Control Measures

Mercury Load Avoidance and Reduction

The Permittees are actively implementing mercury recycling programs in all W/MAs in order to reduce mercury loading to the Bay.

Illegal Dumping Cleanup

The Permittees does identify and clean up illegal dumping of construction and demolition debris where illegal dumping of construction and demolition debris occurs.

Stockpiles, Spills, and Disposal of PCBs

Stockpiles and spills of PCBs are addressed as they are identified through industrial facility inspection and spill notification programs.

8 CITY OF LAFAYETTE

8.1 List of Watersheds / Management Areas and Control Measures

The W/MAs within the City of Lafayette are listed in Table 8-1 below.

Table 8-1: City of Lafayette PCBs and Mercury Watershed Management Areas (W/MAs) and Associated Land Uses

W/MA Identifier	Total Area[1] (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
LAF-1: Old Urban	5,869.8	0	100.0	0	0	0

Notes: Control measure implementation data may be incomplete for FY 2021/22.

1. Land use breakdown as of IMR land use year 2013.

The control measures that are currently being implemented during the term of the permit in each of these W/MAs are summarized in Table 8-2 and are described in the sections below.

Table 8-2: City of Lafayette Area Treated by Area-Based Control Measure Category (FY 2013/14 through FY 2021/22)

Control Measure Category	Total Area Treated (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
Green Infrastructure and Treatment	27.5	0	69.5	0	30.5	0
Large Full Trash Capture Devices	0	0	0	0	0	0
Enhanced O&M Measures[1]	31.8	0	95.0	5.0	0	0

Notes:

1. Includes enhanced street sweeping, enhanced storm drain inlet cleaning, and full trash capture device clean out.

8.2 Scope and Schedule of PCBs Control Measures

8.2.1 Source Property Identification and Abatement

PCBs-Contaminated Properties Referred to the Regional Water Board

The City of Lafayette has no known or suspected source properties. No properties within the City of Lafayette have been referred to the SFBRWQCB as a result of implementation of the Source Property Identification and Abatement control measure to date.

Ongoing Investigations

No further investigations are warranted in the City of Lafayette.

8.2.2 Green Infrastructure / Treatment Control Measures

The City of Lafayette requires all new development, redevelopment, and infrastructure projects within the City to comply with the applicable sections of the MRP Provision C.3 and demolition standards at the time of application. When projects are determined to be unregulated, the City requires the project to implement LID design standards to the fullest extent practicable. Although limited opportunities are available to incorporate green infrastructure into the City's capital improvement program, the City will continue to look for opportunities to incorporate green infrastructure when possible. See the City of Lafayette's Green Infrastructure Plan for further information.

8.2.3 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

The Program and Permittees actively participated in a BASMAA Regional Project to address PCBs in building materials as described in Section 2.3.1. The City of Lafayette began implementation of the program on July 1, 2019.

Managing PCBs in Infrastructure

The Program and Permittees also participated in a BASMAA Regional Project to address PCBs in infrastructure as described in Section 2.3.2.

8.2.4 Enhanced Operation and Maintenance Control Measures

The City of Lafayette has been street sweeping since 1969. Though the program has changed throughout the years, the areas swept today include commercial and arterial streets once a week, residential streets once a month, and City owned parking lots once a month. This schedule amounts to approximately 6,400 acres swept a year and was established pre-MRP.

Established before fiscal year 2013/2014, the City of Lafayette has been cleaning drain inlets once a year in preparation of the wet season except for the inlet-based full trash capture units which are currently professionally cleaned three times per year. If any drain inlet is in need of maintenance between cleanings or was missed because of lack of access, the City's maintenance crew performs the cleaning. The City of Lafayette also employs Futures Explored trash pickup patrols to clean up liter in the downtown where a majority of the pedestrian traffic is and hosts an annual creek cleanup day.

Since fiscal year 2013/2014, enhanced O&M control measures that have been implemented by the City of Lafayette are more on-land trash pickups as trash is seen and as needed, and installation of new double recycle/trash cans around the downtown. These activities have resulted in increased trash reduction above what is required by the permit.

8.2.5 Diversion to POTW

No diversion to POTW control measures are proposed.

8.2.6 Source Controls and Other Control Measures

Mercury Load Avoidance and Reduction

The Permittees are actively implementing mercury recycling programs in all W/MAs in order to reduce mercury loading to the Bay. As street lighting containing mercury or high-pressure sodium pressure lighting fixtures fail, the City of Lafayette is properly disposing of the old fixture and replacing it with LED lighting.

Illegal Dumping Cleanup

The Permittees will identify and cleanup illegal dumping of construction and demolition debris where illegal dumping of construction and demolition debris occurs. The City of Lafayette also picks up other illegally dumped items within the public right-of-way as they become known.

Stockpiles, Spills, and Disposal of PCBs

Stockpiles and spills of PCBs will be addressed as they are identified through industrial facility inspection and spill notification programs. The City of Lafayette has experienced no specific PCBs incidents of dumping that require cleanup to date.

9 CITY OF MARTINEZ

9.1 List of Watersheds / Management Areas and Control Measures

The W/MAs within the City of Martinez are listed in Table 9-1 below.

Table 9-1: City of Martinez PCBs and Mercury Watershed Management Areas (W/MAs) and Associated Land Uses

W/MA Identifier	Total Area[1] (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
MTZ-1: Old Urban	2,776.0	0	100.0	0	0	0
MTZ-2: Refinery/Industrial	648.2	51.5	7.1	19.0	22.4	0
MTZ-3: Downtown/Commercial	177.7	31.1	42.1	24.8	2.1	0
MTZ-PGE: Categorical PG&E	16.8	7.8	27.0	0	65.3	0
MTZ-RAIL: Categorical Railroad	10.8	61.5	9.9	0	28.6	0

Notes:

1. Land use breakdown as of IMR land use year 2013.

The control measures that are currently being implemented during the term of the permit in each of these W/MAs are summarized in Table 9-2 and are described in the sections below.

Table 9-2: City of Martinez Area Treated by Area-Based Control Measure Category (FY 2013/14 through FY 2021/22)

Control Measure Category	Total Area Treated (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
Green Infrastructure and Treatment	72.3	15.2	36.7	32.6	15.5	0
Large Full Trash Capture Devices	4.1	39.0	53.7	7.3	0	0
Enhanced O&M Measures[1]	410.9	1.8	63.0	15.5	19.6	0

Notes:

1. Includes enhanced street sweeping and inlet-based full trash capture device clean out.

9.2 Scope and Schedule of PCBs Control Measures

9.2.1 Source Property Identification and Abatement

PCBs-Contaminated Properties Referred to the Regional Water Board

No properties within the City of Martinez have been referred to the SFBRWQCB as a result of implementation of the Source Property Identification and Abatement control measure to date.

Ongoing Investigations

The City of Martinez conducted visual windshield inspection of potential Old Industrial and High Likelihood parcels. Although no investigations are currently underway, future investigations have the potential to result in a property referral.

9.2.2 Green Infrastructure / Treatment Control Measures

As required by the MRP, all regulated development, redevelopment, capital improvement, and infrastructure projects within the W/MA will be subject to the development standards in effect at the time an application is made, and the applicable provisions of Section C.3 of the MRP, including the installation of low impact development drainage design facilities such as bioretention basins. Non-regulated projects are encouraged to install one or more LID elements. See the City of Martinez's Green Infrastructure Plan for further information.

9.2.3 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

The Program and Permittees actively participated in a BASMAA Regional Project to address PCBs in building materials as described in Section 2.3.1. The City of Martinez began implementation of the program on July 1, 2019.

Managing PCBs in Infrastructure

The Program and Permittees participated in a BASMAA Regional Project to address PCBs in infrastructure as described in Section 2.3.2.

9.2.4 Enhanced Operation and Maintenance Control Measures

Enhanced O&M control measures that have been implemented by the City of Martinez include clean out of inlet-based full trash capture devices on a semi-annual basis and enhanced street sweeping.

9.2.5 Diversion to POTW

No diversion to POTW control measures are proposed.

9.2.6 Source Controls and Other Control Measures

Mercury Load Avoidance and Reduction

The Permittees are actively implementing mercury recycling programs in all W/MAs in order to reduce mercury loading to the Bay.

- In 2014, the City replaced 487 streetlights (throughout the City) from high-pressure sodium (HPS) lamps to LED. The replaced lights contain approximately 25 mg /each of mercury.
- In FY 2013-14 & FY 2014-15, the City replaced approximately 3,910 linear feet of florescent lights. The replaced lights contain approximately 2.5 mg mercury/linear foot.
- In FY 2013-14 & FY 2014-15, the City replaced approximately 97 compact lights. The replaced lights contain approximately 5 mg mercury/each.

Illegal Dumping Cleanup

The Permittees will identify and cleanup illegal dumping of construction and demolition debris where illegal dumping of construction and demolition debris occurs.

Stockpiles, Spills, and Disposal of PCBs

Stockpiles and spills of PCBs will be addressed as they are identified through industrial facility inspection and spill notification programs.

10 TOWN OF MORAGA

10.1 List of Watersheds / Management Areas and Control Measures

The W/MAs within the Town of Moraga are listed in Table 10-1 below.

Table 10-1: Town of Moraga PCBs and Mercury Watershed Management Areas (W/MAs) and Associated Land Uses

W/MA Identifier	Total Area[1] (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
MOR-1: Old Industrial	22.8	100.0	0	0	0	0
MOR-2: Old Urban	2,382.4	0	99.9	0	0.1	0

Notes:

1. Land use breakdown as of IMR land use year 2013.

The control measures that are currently being implemented during the term of the permit in each of these W/MAs are summarized in Table 10-2 and are described in the sections below.

Table 10-2: Town of Moraga Area Treated by Area-Based Control Measure Category (FY 2013/14 through FY 2021/22)

Control Measure Category	Total Area Treated (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
Green Infrastructure and Treatment	18.9	0	36.0	0	64.0	0
Large Full Trash Capture Devices	0	0	0	0	0	0
Enhanced O&M Measures[1]	198.3	15.3	76.3	2.9	5.4	0

Notes: Control measure implementation data may be incomplete for FY 2021 -2022.

1. Includes inlet-based full trash capture device clean out.

10.2 Scope and Schedule of PCBs Control Measures

10.2.1 Source Property Identification and Abatement

PCBs-Contaminated Properties Referred to the Regional Water Board

No properties within the Town of Moraga have been referred to the SFBRWQCB as a result of implementation of the Source Property Identification and Abatement control measure to date.

Ongoing Investigations

No further investigations are warranted in the Town of Moraga.

10.2.2 Green Infrastructure / Treatment Control Measures

Any development, redevelopment, and infrastructure projects within each of the W/MAs will be subject to the development standards in effect at the time an application is made, such as demolition standards and applicable provisions of section C.3. See the Town of Moraga's Green Infrastructure Plan for further information.

10.2.3 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

The Town of Moraga participated in the BASMAA Regional Project to address PCBs in building materials as described in Section 2.3.1. Moraga began implementation of the program on July 1, 2019.

Managing PCBs in Infrastructure

The Program and Permittees participated in a BASMAA Regional Project to address PCBs in infrastructure as described in Section 2.3.2.

10.2.4 Enhanced Operation and Maintenance Control Measures

Enhanced O&M control measures that have been implemented by the Town of Moraga include clean out of inlet-based full trash capture devices on a semi-annual basis.

10.2.5 Diversion to POTW

No diversion to POTW control measures are proposed.

10.2.6 Source Controls and Other Control Measures

Mercury Load Avoidance and Reduction

The Permittees are actively implementing mercury recycling programs in order to reduce mercury loading to the Bay.

Illegal Dumping Cleanup

The Permittees will identify, and cleanup illegal dumping of construction and demolition debris as needed.

Stockpiles, Spills, and Disposal of PCBs

Stockpiles and spills of PCBs are addressed as they are identified through industrial facility inspection and spill notification programs.

11 CITY OF ORINDA

11.1 List of Watersheds / Management Areas and Control Measures

The W/MAs within the City of Orinda are listed in Table 11-1 below.

Table 11-1: City of Orinda PCBs and Mercury Watershed Management Areas (W/MAs) and Associated Land Uses

W/MA Identifier	Total Area[1] (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
ORI-1: Old Urban	5,274.1	0	93.9	0	6.0	0
ORI-2: Downtown	44.0	0	97.5	0.5	2.0	0
ORI-PGE: Categorical PG&E	154.0	22.7	0.1	4.0	73.2	0

Notes:

1. Land use breakdown as of IMR land use year 2013.

The control measures that are currently being implemented during the term of the permit in each of these W/MAs are summarized in Table 11-2 and are described in the sections below.

Table 11-2: City of Orinda Area Treated by Area-Based Control Measure Category (FY 2013/14 through FY 2021/22)

Control Measure Category	Total Area Treated (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
Green Infrastructure and Treatment	17.0	0	100.0	0	0	0
Large Full Trash Capture Devices	0	0	0	0	0	0
Enhanced O&M Measures[1]	33.4	0	99.7	0	0.3	0

Notes: Control measure implementation data may be incomplete for FY 2021 -2022.

1. Includes enhanced street sweeping and inlet-based full trash capture device clean out.

11.2 Scope and Schedule of PCBs Control Measures

11.2.1 Source Property Identification and Abatement

PCBs-Contaminated Properties Referred to the Regional Water Board

No properties within the City of Orinda have been referred to the SFBRWQCB as a result of implementation of the Source Property Identification and Abatement control measure to date.

Ongoing Investigations

The City of Orinda is largely old urban. There are no suspected source properties contained in the City of Orinda's W/MAs. The only old industrial areas are owned and operated by PG&E and included in WMA 4. Therefore, no ongoing inspection or abatement is required.

11.2.2 Green Infrastructure / Treatment Control Measures

The City of Orinda requires developers to follow the Stormwater C.3 Guidebook developed by the Contra Costa Clean Water Program for all new development or redevelopment. See the City of Orinda's Green Infrastructure Plan for further information.

11.2.3 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

The Program and Permittees are actively participating in a BASMAA Regional Project to address PCBs in building materials as described in Section 2.3.1.

Managing PCBs in Infrastructure

The Program and Permittees participated in a BASMAA Regional Project to address PCBs in infrastructure as described in Section 2.3.2. Orinda began implementation of the program on July 1, 2019.

11.2.4 Enhanced Operation and Maintenance Control Measures

Enhanced O&M control measures that have been implemented by the City of Orinda include clean out of inlet-based full trash capture devices on a semi-annual basis and enhanced street sweeping.

11.2.5 Diversion to POTW

No diversion to POTW control measures are proposed.

11.2.6 Source Controls and Other Control Measures

Mercury Load Avoidance and Reduction

The Permittees are actively implementing mercury recycling programs in all W/MAs in order to reduce mercury loading to the Bay.

Illegal Dumping Cleanup

The Permittees will identify and cleanup illegal dumping of construction and demolition debris where illegal dumping of construction and demolition debris occurs.

Stockpiles, Spills, and Disposal of PCBs

Stockpiles and spills of PCBs will be addressed as they are identified through industrial facility inspection and spill notification programs.

12 CITY OF PINOLE

12.1 List of Watersheds / Management Areas and Control Measures

The W/MAs within the City of Pinole are listed in Table 12-1 below.

Table 12-1: City of Pinole PCBs and Mercury Watershed Management Areas (W/MAs) and Associated Land Uses

W/MA Identifier	Total Area[1] (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
PIN-1: Old Industrial/ High Likelihood	95.0	64.8	7.0	21.5	6.6	0
PIN-2: Old Urban Commercial	367.7	0	91.1	0.9	7.9	0
PIN-3: Old Urban Residential	1,919.3	0	85.5	1.5	13.0	0
PIN-PGE: Categorical PG&E	4.6	0	0	0.	100.0	0
PIN-RAIL: Categorical Railroad	3.6	13.6	0	0	86.4	0

Notes:

1. Land use breakdown as of IMR land use year 2013.

The control measures that are currently being implemented during the term of the permit in each of these W/MAs are summarized in Table 12-2 and are described in the sections below.

Table 12-2: City of Pinole Area Treated by Area-Based Control Measure Category (FY 2013/14 through FY 2021/22)

Control Measure Category	Total Area Treated (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
Green Infrastructure and Treatment	22.9	0	80.8	0	19.2	0
Large Full Trash Capture Devices	18.0	70.0	7.8	0	22.2	0
Enhanced O&M Measures[1]	206.2	5.6	84.6	6.2	3.6	0

Notes: Control measure implementation data may be incomplete for FY 2021 -2022.

1. Includes inlet-based full trash capture device clean out.

12.2 Scope and Schedule of PCBs Control Measures

12.2.1 Source Property Identification and Abatement

PCBs-Contaminated Properties Referred to the Regional Water Board

No properties within the City of Pinole have been referred to the SFBRWQCB as a result of implementation of the Source Property Identification and Abatement control measure to date.

Ongoing Investigations

Ongoing investigations may result in a property referral in the future.

12.2.2 Green Infrastructure / Treatment Control Measures

Any development, redevelopment, and infrastructure projects within each of the W/MAs will be subject to the development standards in effect at the time an application would be made, such as demolition standards and applicable provisions of section C.3. See the City of Pinole's Green Infrastructure Plan for further information.

12.2.3 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

The Program and Permittees are actively participating in a BASMAA Regional Project to address PCBs in building materials as described in Section 2.3.1. Pinole began implementation of the program on July 1, 2019.

A universal waste and suspect hazardous building materials inventory was conducted prior to demolition activities on a 3-story commercial building and associated outbuilding located at 1617 and 1627 Canyon Drive in Pinole in February 2017. This inventory identified 100 gallons of hydraulic fluid in the passenger elevator equipment above ground storage tank that was suspected of containing PCBs that was recommended for proper disposal.

Managing PCBs in Infrastructure

The Program and Permittees participated in a BASMAA Regional Project to address PCBs in infrastructure as described in Section 2.3.2.

12.2.4 Enhanced Operation and Maintenance Control Measures

Enhanced O&M control measures that have been implemented by the City of Pinole include clean out of inlet-based full trash capture devices on a semi-annual basis.

12.2.5 Diversion to POTW

No diversion to POTW control measures are proposed.

12.2.6 Source Controls and Other Control Measures

Mercury Load Avoidance and Reduction

The Permittees are actively implementing mercury recycling programs in all W/MAs in order to reduce mercury loading to the Bay.

Illegal Dumping Cleanup

The Permittees does identify and cleanup illegal dumping of construction and demolition debris where illegal dumping of construction and demolition debris occurs.

Stockpiles, Spills, and Disposal of PCBs

Stockpiles and spills of PCBs are addressed as they are identified through industrial facility inspection and spill notification programs.

13 CITY OF PITTSBURG

13.1 List of Watersheds / Management Areas and Control Measures

The W/MAs within the City of Pittsburg are listed in Table 13-1 below.

Table 13-1: City of Pittsburg PCBs and Mercury Watershed Management Areas (W/MAs) and Associated Land Uses

W/MA Identifier	Total Area[1] (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
PIT-1: Old Urban	3,042.6	0	100.0	0	0	0
PIT-2: Southern Energy Delta/ Genon	859.0	28.4	0	0	71.6	0
PIT-3: USS Posco Industries	442.6	80.1	0	19.9	0	0
PIT-4: Dow Chemical Company	433.5	66.3	1.2	7.9	24.6	0
PIT-5: Old Industrial	78.6	56.0	16.4	10.3	17.3	0
PIT-6: Camp Stoneman	382.8	84.2	1.4	8.6	5.9	0
PIT-7: Waterfront Industrial	84.2	89.6	0	9.3	1.0	0
PIT-PGE: Categorical PG&E	348.3	12.5	3.1	0.7	83.7	0
PIT-RAIL: Categorical Railroad	106.2	93.0	0	3.1	3.9	0

Notes:

1. Land use breakdown as of IMR land use year 2013.

The control measures that are currently being implemented during the term of the permit in each of these W/MAs are summarized in Table 13-2 and are described in the sections below.

Table 13-2: City of Pittsburg Area Treated by Area-Based Control Measure Category (FY 2013/14 through FY 2021/22)

Control Measure Category	Total Area Treated (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
Source Property Identification and Abatement	6.0	100.0	0	0	0	0
Green Infrastructure and Treatment	176.6	16.9	26.6	28.8	27.7	0
Large Full Trash Capture Devices[1]	436.4	1.8	62.9	33.0	2.3	0

Control Measure Category	Total Area Treated (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
Enhanced O&M Measures[2]	221.8	1.7	41.2	34.5	22.6	0

Notes:

1. Includes Hydrodynamic Separator (HDS) and Gross Solids Removal Device (GSRD) units.
2. Includes inlet-based full trash capture device clean out.

13.2 Scope and Schedule of PCBs Control Measures

13.2.1 Source Property Identification and Abatement

PCBs-Contaminated Properties Referred to the Regional Water Board

One property within the City of Pittsburg was referred to the SFBRWQCB in FY 2015-16 as a result of implementation of the Source Property Identification and Abatement control measure to date.

Table 13-3: City of Pittsburg Contaminated Sites Self-Abated or Referred to the SFBRWQCB (FY 2013/14 through FY 2019/20)

SITE NAME	LOCATION/APN	PROPERTY SIZE (ACRES)	YEAR	Referral/ Self-Abatement
Former Molino Enterprises. Inc.	1215 Willow Pass Rd., Pittsburg; 096-091-003-2	6.0	FY 2015-16	Referral

Ongoing Investigations

Ongoing investigations of other parcels may result in a property referral in the future.

13.2.2 Green Infrastructure / Treatment Control Measures

Any development, redevelopment, and infrastructure projects within each of the W/MAs will be subject to the development standards in effect at the time an application is made, such as demolition standards and applicable provisions of section C.3. See the City of Pittsburg's Green Infrastructure Plan for further information.

13.2.3 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

The City of Pittsburg participated in the BASMAA Regional Project to address PCBs in building materials as described in Section 2.3.1. The City began implementation of the program on July 1, 2019. The City received a Community-wide Brownfield Assessment Grant to conduct Phase I and Phase II Environmental Site Assessments on City-owned and private parcels. As part of this effort, five parcels will be sampled for contaminants including PCBs.

Managing PCBs in Infrastructure

The City also participated in the BASMAA Regional Project to address PCBs in infrastructure as described in Section 2.3.2.

13.2.4 Enhanced Operation and Maintenance Control Measures

Enhanced O&M control measures that have been implemented by the City of Pittsburg include clean out of inlet-based full trash capture devices on a semi-annual basis. In addition, the City of Pittsburg enhanced the street sweeping schedule for more effective street sweeping and debris removal. Staff will explore the possibility of incorporating other enhancements in conjunction with maintenance of the MS4.

13.2.5 Diversion to POTW

No diversion to POTW control measures are proposed.

13.2.6 Source Controls and Other Control Measures

Mercury Load Avoidance and Reduction

The City participates in a regional Household Hazardous Wastes program with the Delta Household Hazardous Waste Facility. The City promotes the use of this facility for the collection of mercury containing items for residents and small businesses through brochures and through contact with the general public at year-round publicly hosted events.

The Permittees are actively implementing mercury recycling programs in order to reduce mercury loading to the Bay.

Illegal Dumping Cleanup

The City is active at identifying and removing illegally dumped construction and demolition debris. The City has Public Works staff dedicated to addressing illegally dumped material within the Public Right of Ways and City owned property. Debris is typically removed as discovered by staff, or within 24 hours of a notification. PW staff are trained on the proper disposal protocols for hazardous substances.

Stockpiles, Spills, and Disposal of PCBs

Stockpiles and spills of PCBs will be addressed as they are identified through industrial facility inspection and spill notification programs.

14 CITY OF PLEASANT HILL

14.1 List of Watersheds / Management Areas and Control Measures

The W/MAs within the City of Pleasant Hill are listed in Table 14-1 below.

Table 14-1: City of Pleasant Hill PCBs and Mercury Watershed Management Areas (W/MAs) and Associated Land Uses

W/MA Identifier	Total Area[1] (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
PLH-1: Old Urban	4,509.0	0	80.2	6.3	13.5	0
PLH-2: Old Industrial	20.2	100.0	0	0	0	0

Notes:

1. Land use breakdown as of IMR land use year 2013.

The control measures that are currently being implemented during the term of the permit in each of these W/MAs are summarized in Table 14-2 and are described in the sections below.

Table 14-2: City of Pleasant Hill Area Treated by Area-Based Control Measure Category (FY 2013/14 through FY 2021/22)

Control Measure Category	Total Area Treated (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
Green Infrastructure and Treatment	72.0	0	99.9	0	0.1	0
Large Full Trash Capture Devices	35.8	0	93.6	6.1	0.3	0
Enhanced O&M Measures[1]	547.8	0	94.5	2.5	3.0	0

Notes: Control measure implementation data may be incomplete for FY 2021 -2022.

1. Includes inlet-based full trash capture device clean out.

14.2 Scope and Schedule of PCBs Control Measures

14.2.1 Source Property Identification and Abatement

PCBs-Contaminated Properties Referred to the Regional Water Board

No properties within the City of Pleasant Hill have been referred to the SFBRWQCB as a result of implementation of the Source Property Identification and Abatement control measure to date.

Ongoing Investigations

The City of Pleasant Hill has not identified any source properties but will continue its inspection of commercial/industrial facilities required by Provision C.4 which may identify source properties in the future, albeit unlikely given the commercial rather than industrial nature of the facilities inspected. Ongoing investigations may result in a property referral in the future.

14.2.2 Green Infrastructure / Treatment Control Measures

Any development, redevelopment, and infrastructure projects within each of the W/MAs will be subject to the development standards in effect at the time an application is made, such as demolition standards and applicable provisions of section C.3. See the City of Pleasant Hill's Green Infrastructure Plan for further information.

14.2.3 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

The Program and Permittees actively participated in a BASMAA Regional Project to address PCBs in building materials as described in Section 2.3.1. The City of Pleasant Hill began implementation of the program on July 1, 2019.

Managing PCBs in Infrastructure

The Program and Permittees participated in a BASMAA Regional Project to address PCBs in infrastructure as described in Section 2.3.2.

14.2.4 Enhanced Operation and Maintenance Control Measures

Enhanced O&M control measures that have been implemented by the City of Pleasant Hill include clean out of inlet-based full trash capture devices on a semi-annual basis.

14.2.5 Diversion to POTW

No diversion to POTW control measures are proposed.

14.2.6 Source Controls and Other Control Measures

Mercury Load Avoidance and Reduction

The Permittees are actively implementing mercury recycling programs in all W/MAs in order to reduce mercury loading to the Bay.

Illegal Dumping Cleanup

The Permittees does identify and cleanup illegal dumping of construction and demolition debris where illegal dumping of construction and demolition debris occurs.

Stockpiles, Spills, and Disposal of PCBs

Stockpiles and spills of PCBs are addressed as they are identified through industrial facility inspection and spill notification programs.

15 CITY OF RICHMOND

15.1 List of Watersheds / Management Areas and Control Measures

The W/MAs within the City of Richmond are listed in Table 15-1 below.

Table 15-1: City of Richmond PCBs and Mercury Watershed Management Areas (W/MAs) and Associated Land Uses

W/MA Identifier	Total Area[1] (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
RIC-1: Old Urban	5,563.0	6.3	85.1	4.9	3.7	0
RIC-2: Point Pinole	329.4	31.6	0	31.9	36.5	0
RIC-3: Santa Fe Channel	833.6	63.8	7.0	6.5	22.7	0
RIC-4: Zeneca Site	63.4	100.0	0	0	0	0
RIC-PGE: Categorical PG&E	6.6	42.7	0	15.5	41.9	0
RIC-Rail: Categorical Rail	467.6	80.9	5.7	1.1	12.3	0

Notes:

1. Land use breakdown as of IMR land use year 2013.

The control measures that are currently being implemented during the term of the permit in each of these W/MAs are summarized in Table 15-2 and are described in the sections below.

Table 15-2: City of Richmond Area Treated by Area-Based Control Measure Category (FY 2013/14 through FY 2021/22)

Control Measure Category	Total Area Treated (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
Source Property Identification and Abatement	30.5	100.0	0	0	0	0
Green Infrastructure and Treatment	350.8	43.1	22.8	7.2	26.9	0
Large Full Trash Capture Devices[1]	2,786.5	5.6	89.7	2.4	2.3	0
Enhanced O&M Measures[2]	970.7	5.0	89.2	3.7	2.1	0

Notes: Control measure implementation data may be incomplete for FY 2021/22.

1. Includes Hydrodynamic Separator (HDS) and Gross Solids Removal Device (GSRD) units.
2. Includes inlet-based full trash capture device clean out.

15.2 Scope and Schedule of PCBs Control Measures

15.2.1 Source Property Identification and Abatement

PCBs-Contaminated Properties Referred to the Regional Water Board

Six properties within the City of Richmond have been referred to the SFBRWQCB or have been abated as a result of implementation of the Source Property Identification and Abatement control measure to date (Table 15-3). Two new source properties were identified in FY 2019/20 – Zeneca and the UC Berkeley Richmond Field Station. Both of these properties discharge directly to the Bay, therefore there is no opportunity for the City of Richmond to implement enhanced O&M measures. Thus, no load reduction credit has been taken for these source property referrals.

Table 15-3: City of Richmond Contaminated Sites Self-Abated or Referred to the SFBRWQCB (FY 2013/14 through FY 2019/20)

SITE NAME	LOCATION/APN	PROPERTY SIZE (ACRES)	YEAR	Referral/ Self-Abatement
Zeneca/Former Stauffer Chemical Company	1415 South 47th St, Richmond	9.2	FY 2019/20	Referral
UC Berkeley Richmond Field Station	1301 South 46th St, Richmond	14	FY 2019/20	Referral
Sims Metal Management Richmond Facility	600 South 4th Street, Richmond / 560-240-040, 560-250-027, 560-250-025	19.3	FY 2017-18	Referral
World Corp	1014 Chesley Ave., Richmond	10.44	FY 2017-18	Referral
Port of Richmond	Point Potrero Marine Terminal, Richmond	0.72	FY 2017-18	Self-Abatement
San Diego St. Transformer Spill	R.O.W. San Diego St., Richmond	0.08	FY 2017-18	Self-Abatement

Ongoing Investigations

The City of Richmond, through its C.4 business inspection program, continuously inspects and investigates industrial and commercial properties for potential sources of PCBs in the Santa Fe Channel, Zeneca, and North Richmond management areas. Moreover, City staff inspects PG&E maintenance yards, located in its jurisdiction, to warrant that all PCBs containing transformers and equipment are properly contained and disposed. Ongoing investigations may result in a property referral in the future.

Through the plan checking process, any properties that apply for grading permits for the purpose of site remediation under clean up orders by State regulatory agencies (i.e., State Water Resources Control Board and Department of Toxic Substance Control) are required to submit monitoring results for PCBs prior to permit issuance.

Currently, the City does not perform any source identification in residential Old Urban or New Urban management areas.

15.2.2 Green Infrastructure / Treatment Control Measures

Development and redevelopment projects in all management areas are subjected to the Contra Costa County C.3 requirements. See the City of Richmond's Green Infrastructure Plan for further information.

15.2.3 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

The Program and Permittees actively participated in a BASMAA Regional Project to address PCBs in building materials as described in Section 2.3.1. Richmond began implementation of the program on July 1, 2019.

Managing PCBs in Infrastructure

The Program and Permittees participated in a BASMAA Regional Project to address PCBs in infrastructure as described in Section 2.3.2.

15.2.4 Enhanced Operation and Maintenance Control Measures

Enhanced O&M control measures that have been implemented by the City of Richmond include clean out of inlet-based full trash capture devices on a semi-annual basis.

15.2.5 Diversion to POTW

No diversion to POTW control measures are proposed.

15.2.6 Source Controls and Other Control Measures

Mercury Load Avoidance and Reduction

The Permittees are actively implementing mercury recycling programs in all W/MAs in order to reduce mercury loading to the Bay.

Illegal Dumping Cleanup

The Permittees will identify and cleanup illegal dumping of construction and demolition debris where illegal dumping of construction and demolition debris occurs.

The City of Richmond utilizes the 1-800-NO DUMPING hotline for reports of illegal dumping activities. When reports are received by the City abatement crew, illegally dumped materials are abated and sorted according to the type of wastes and disposed of accordingly.

Stockpiles, Spills, and Disposal of PCBs

Stockpiles and spills of PCBs will be addressed as they are identified through industrial facility inspection and spill notification programs.

The City of Richmond staff diligently investigates, enforces, and follows up on the removal, disposal, and remediation of spills from transformers belonging to PG&E as they are reported.

16 CITY OF SAN PABLO

16.1 List of Watersheds / Management Areas and Control Measures

The W/MAs within the City of San Pablo are listed in Table 16-1 below.

Table 16-1: City of San Pablo PCBs and Mercury Watershed Management Areas (W/MAs) and Associated Land Uses

W/MA Identifier	Total Area[1] (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
SPB-1: Rumrill Industrial Area	45.2	22.9	52.7	16.7	7.7	0
SPB-2: Giant Highway Industrial Area	22.7	73.9	9.5	16.5	0	0
SPB-3: Old Urban	1,599.1	0.8	88.4	0.6	10.2	0
SPB-RAIL	0.1	89.3	10.7	0	0	0
SPB-PG&E	0.2	0	0	0	100.0	0

Notes:

1. Land use breakdown as of IMR land use year 2013.

The control measures that are currently being implemented during the term of the permit in each of these W/MAs are summarized in Table 16-2 and are described in the sections below. The City will be assessing Clean Watersheds for a Clean Bay results, development applications, sampling results, and other pilot projects to gain a clear understanding of the economic and environmental impacts of each project. The City will use this information to make informed decisions in the future about funding programs that provide additional PCBs and mercury reductions.

Table 16-2: City of San Pablo Area Treated by Area-Based Control Measure Category (FY 2013/14 through FY 2021/22)

Control Measure Category	Total Area Treated (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
Source Property Identification and Abatement	4.5	100.0	0	0	0	0
Green Infrastructure and Treatment	36.6	10.9	69.1	0.8	19.1	0
Large Full Trash Capture Devices	0	0	0	0	0	0

Control Measure Category	Total Area Treated (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
Enhanced O&M Measures[1]	660.1	2.6	90.9	2.3	4.2	0

Notes:

1. Includes inlet-based full trash capture device clean out.

16.2 Scope and Schedule of PCBs Control Measures

16.2.1 Source Property Identification and Abatement

Over the 2014-2015 and 2015-2016 reporting periods the City of San Pablo (in conjunction with the Contra Costa Clean Water Program) screened 132 parcels, revised the high-likelihood parcels to 11 and collected samples at six of the 11 sites. Of the six samples collected, there was one sample in the City of San Pablo that contained PCBs levels above 1.0 mg/kg.

Since the initial sampling, the City of San Pablo performed further research into the neighborhood surrounding the site with the elevated PCBs sample and learned that this area is adjacent to a previously referred (2009) PCBs contaminated site; however, this site is located in a different jurisdiction. In January 2017, the City of San Pablo in conjunction with CCCWP performed additional sampling to eliminate other properties surrounding the area and worked with the Contra Costa Clean Water Program and the City of Richmond to perform sediment sampling around the previously referred PCBs contaminated site at 1014 Chesley Avenue. One additional sampling event occurred in May 2017, which confirmed that the site was still leaking PCBs into the public right-of-way. Over the 2017-2018, reporting year the City of San Pablo transferred this site to the City of Richmond since the property is located in the City of Richmond's jurisdiction. The City of San Pablo will continue to work with the City of Richmond and SFBRWQCB regarding the status of this property, however information regarding this progress can be found in the City of Richmond section.

In addition, the City of San Pablo attended various meetings regarding a potential contaminated site at 1411 Rumrill Avenue in San Pablo. The City attended a meeting in February 2018 to discuss the potential for an abatement process and credit for this abatement. The City is currently working on a "complete streets" project that will address runoff from this parcel. The site is currently under construction. Once constriction is complete, the City will submit documentation for abatement of the site.

PCBs-Contaminated Properties Referred to the Regional Water Board

No properties within the City of San Pablo have been referred to the SFBRWQCB as a result of implementation of the Source Property Identification and Abatement control measure to date. While no properties within the City of San Pablo have been referred to the Regional Water Board by the Contra Costa Clean Water Program, one PCBs-contaminated self-abated property has been reported to the SFBRWQCB.

Table 16-3: City of San Pablo Contaminated Sites Self-Abated or Referred to the SFBRWQCB (FY 2013/14 through FY 2019/20)

SITE NAME	LOCATION/APN	PROPERTY SIZE (ACRES)	YEAR REFERRED	Referral/ Self-Abatement
Rumrill Sports Complex (Former BNSF Railyard Site)	1509 Rumrill Blvd, San Pablo / 409-313-009; 409-313-009; 410-012-007; 410-012-008	4.45	FY 2015-16	Self-Abatement

Ongoing Investigations

Ongoing investigations may result in a property referral in the future.

16.2.2 Green Infrastructure / Treatment Control Measures

Any development, redevelopment, and infrastructure projects within each of the W/MAs will be subject to the development standards in effect at the time an application is made, such as demolition standards and applicable provisions of section C.3. See the City of San Pablo's Green Infrastructure Plan for further information.

16.2.3 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

The Program and Permittees actively participated in a BASMAA Regional Project to address PCBs in building materials as described in Section 2.3.1. The City of San Pablo assisted in this project by providing municipality representatives in the Technical Advisory Committee and the Steering Committee. The City began full implementation of the program on July 1, 2019.

Managing PCBs in Infrastructure

The Program and Permittees participated in a BASMAA Regional Project to address PCBs in infrastructure as described in Section 2.3.2.

16.2.4 Enhanced Operation and Maintenance Control Measures

Enhanced O&M control measures that have been implemented by the City of San Pablo include clean out of inlet-based full trash capture devices on a semi-annual basis.

In the 2016-17 reporting year, the City of San Pablo desilted 400 linear feet of Wildcat Creek to remove sediment that is blocking storm drains. This desilting project resulted in the removal of 800 cubic yards of sediment from the creek. As the data needed to determine the PCBs and mercury load reductions for this desilting are not available, no load reduction credit has been included in this report for this project.

16.2.5 Diversion to POTW

No diversion to POTW control measures are proposed.

16.2.6 Source Controls and Other Control Measures

Mercury Load Avoidance and Reduction

The Permittees are actively implementing mercury recycling programs in all W/MAs in order to reduce mercury loading to the Bay.

Illegal Dumping Cleanup

The Permittees will identify and cleanup illegal dumping of construction and demolition debris where illegal dumping of construction and demolition debris occurs.

Stockpiles, Spills, and Disposal of PCBs

Stockpiles and spills of PCBs will be addressed as they are identified through industrial facility inspection and spill notification programs.

17 CITY OF SAN RAMON

17.1 List of Watersheds / Management Areas and Control Measures

The W/MAs within the City of San Ramon are listed in Table 17-1 below.

Table 17-1: **City of San Ramon PCBs and Mercury Watershed Management Areas (W/MAs) and Associated Land Uses**

W/MA Identifier	Total Area[1] (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
SRM-1: Old Urban	916.9	0	93.9	4.7	1.5	0
SRM-PGE: Categorical PG&E	84.5	15.9	13.8	2.6	67.6	0

Notes:

1. Land use breakdown as of IMR land use year 2013.

The City of San Ramon has identified one WMA that covers old urban areas within the City. There are no areas within the City's jurisdiction that are categorized as old industrial land use (pre-1974) as defined in the initial Source Property Identification and Abatement study conducted by the Contra Costa Clean Water Program. There are a limited number of commercial buildings within WMA 1 that were constructed pre-1974. Those units are located within the City of San Ramon Northwest Specific Plan and are subject to redevelopment as the residential and commercial markets develop in the area. One PG&E storage facility that may have contained power transformers will be included in a county-wide categorical WMA.

The control measures that are currently being implemented during the term of the permit in each of these W/MAs are summarized in Table 17-2 and are described in the sections below.

Table 17-2: City of San Ramon Area Treated by Area-Based Control Measure Category (FY 2013/14 through FY 2021/22)

Control Measure Category	Total Area Treated (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
Green Infrastructure and Treatment	336.6	0	2.6	17.3	80.1	0
Large Full Trash Capture Devices	0	0	0	100.0	0	0
Enhanced O&M Measures[1]	232.3	0	39.3	60.1	0.6	0

Notes: Control measure implementation data may be incomplete for FY 2021/22.

1. Includes inlet-based full trash capture device clean out.

17.2 Scope and Schedule of PCBs Control Measures

17.2.1 Source Property Identification and Abatement

PCBs-Contaminated Properties Referred to the Regional Water Board

No properties within the City of San Ramon have been referred to the SFBRWQCB as a result of implementation of the Source Property Identification and Abatement control measure to date.

Ongoing Investigations

No further investigations are warranted in the City of San Ramon.

17.2.2 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

The Program and Permittees actively participated in a BASMAA Regional Project to address PCBs in building materials as described in Section 2.3.1. San Ramon began implementation of the program on July 1, 2019.

Managing PCBs in Infrastructure

The Program and Permittees participated in a BASMAA Regional Project to address PCBs in infrastructure as described in Section 2.3.2.

17.2.3 Enhanced Operation and Maintenance Control Measures

Enhanced O&M control measures that have been implemented by the City of San Ramon include clean out of inlet-based full trash capture devices on a semi-annual basis.

17.2.4 Diversion to POTW

No diversion to POTW control measures are proposed.

17.2.5 Green Infrastructure / Treatment Control Measures

Any development, redevelopment, and infrastructure projects within each of the W/MAs will be subject to the development standards in effect at the time an application is made, such as demolition standards and applicable provisions of section C.3. See the City of San Ramon's Green Infrastructure Plan for further information.

17.2.6 Source Controls and Other Control Measures

Mercury Load Avoidance and Reduction

The Permittees are actively implementing mercury recycling programs in all W/MAs in order to reduce mercury loading to the Bay.

Illegal Dumping Cleanup

The City of San Ramon typically removes items from illegal dumping sites within 24 hours of notification or discovery by staff.

Stockpiles, Spills, and Disposal of PCBs

Stockpiles and spills of PCBs will be addressed as they are identified through industrial facility inspection and spill notification programs.

18 CITY OF WALNUT CREEK

18.1 List of Watersheds / Management Areas and Control Measures

The W/MAs within the City of Walnut Creek are listed in Table 18-1 below.

Table 18-1: City of Walnut Creek PCBs and Mercury Watershed Management Areas (W/MAs) and Associated Land Uses

W/MA Identifier	Total Area[1] (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
WCR-1: Downtown Core	775.7	0.9	96.3	0.4	2.5	0
WCR-2: Shadelands	233.7	5.3	86.4	0	8.3	0

Notes:

1. Land use breakdown as of IMR land use year 2013.

The control measures that are currently being implemented during the term of the permit in each of these W/MAs are summarized in Table 18-2 and are described in the sections below.

Table 18-2: City of Walnut Creek Area Treated by Area-Based Control Measure Category (FY 2013/14 through FY 2021/22)

Control Measure Category	Total Area Treated (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
Green Infrastructure and Treatment	149.3	1.2	84.2	0	14.6	0
Large Full Trash Capture Devices	20.7	0	99.5	0	0.5	0
Enhanced O&M Measures[1]	734.9	0	89.9	3.8	6.3	0

Notes:

1. Includes inlet-based full trash capture device clean out.

18.2 Scope and Schedule of PCBs Control Measures

18.2.1 Source Property Identification and Abatement

PCBs-Contaminated Properties Referred to the Regional Water Board

During renovation of the Larkey Pool swim center, 27 linear feet of PCBs-containing concrete slab expansion joint caulking, approximately 6 inches in width, were removed. The self-abatement form for this project was provided in a previous annual report.

Ongoing Investigations

Ongoing investigations may result in a property referral in the future.

18.2.2 Green Infrastructure / Treatment Control Measures

As required by the Municipal Regional NPDES Permit (MRP, provision C.3.j), the City of Walnut Creek requires the inclusion of low impact development (LID) drainage design into storm drain infrastructure on public and private lands (including streets, storm drains, parking lots, building roofs and others). When a project is not considered as a regulated project under provision C.3 (such as a single-family residence project), it is encouraged to install one or more LID elements. See the City of Walnut Creek's Green Infrastructure Plan for further information.

18.2.3 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

The City of Walnut Creek participated in the BASMAA Regional Project to address PCBs in building materials as described in Section 2.3.1. The City of Walnut Creek began implementation of the program on July 1, 2019.

Managing PCBs in Infrastructure

The City of Walnut Creek also participated in the BASMAA Regional Project to address PCBs in infrastructure as described in Section 2.3.2.

18.2.4 Enhanced Operation and Maintenance Control Measures

Enhanced O&M control measures that have been implemented by the City of Walnut Creek include clean out of inlet-based full trash capture devices on a semi-annual basis.

18.2.5 Diversion to POTW

No diversion to POTW control measures are proposed.

18.2.6 Source Controls and Other Control Measures

Mercury Load Avoidance and Reduction

The City of Walnut Creek participates in the regional recycling efforts of mercury-containing thermometer and devices through the Central Contra Costa Sanitary District (CCCSD) household hazardous waste program.

The Permittees are actively implementing mercury recycling programs in all W/MAs in order to reduce mercury loading to the Bay.

Illegal Dumping Cleanup

The City has not encountered any incidents involving illegal dumping of PCBs and/or mercury containing materials and related cleanups.

The Permittees will identify and cleanup illegal dumping of construction and demolition debris where illegal dumping of construction and demolition debris occurs.

Stockpiles, Spills, and Disposal of PCBs

Stockpiles and spills of PCBs will be addressed as they are identified through industrial facility inspection and spill notification programs.

19 UNINCORPORATED CONTRA COSTA COUNTY

19.1 List of Watersheds / Management Areas and Control Measures

The W/MAs within Unincorporated Contra Costa County are listed in Table 19-1 below. Note that although MRP Provisions C.11/C.12 apply only to the portion of Unincorporated Contra Costa County within Region 2, the County has mapped W/MAs countywide.

Table 19-1: **Unincorporated Contra Costa County PCBs and Mercury Watershed Management Areas (W/MAs) and Associated Land Uses**

W/MA Identifier	Total Area[1] (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
CCC-1: High Likelihood and Source Properties	5,931.2	51.7	9.1	2.8	22.8	13.6
CCC-2: Old Industrial Areas	1,055.0	99.9	0	0	0.1	0
CCC-3: North Richmond Pump Station (NRPS) Drainage Area	182.2	0.1	86.7	3.7	9.6	0
CCC-4: Infrastructure Improvement Areas (old industrial and old urban areas with very limited or no storm drain systems adjacent to industrial areas)	560.8	0	30.3	42.4	27.3	0
CCC-5: Enhanced Operations and Maintenance Areas (old industrial and old urban areas with curb, gutter, and storm drain systems)	1,856.4	0	90.9	2.7	6.3	0
CCC-PGE: Categorical PG&E	1,775.3	3.7	2.2	0.7	93.4	0
CCC-RAIL: Categorical Railroad	639.9	9.8	2.0	15.0	72.4	0.9

Notes:

1. Land use breakdown as of IMR land use year 2013.

These W/MAs are designated based on the types of control measures and actions that may be taken to reduce PCBs flowing or present in the stormwater drainage system. These areas represent priority areas within Contra Costa County. The control measures that are currently being implemented during the term of the permit in each of these W/MAs are summarized in Table 19-2 and are described in the sections below.

Table 19-2: Unincorporated Contra Costa County Area Treated by Area-Based Control Measure Category (FY 2013/14 through FY 2021/22)

Control Measure Category	Total Area Treated (Acres)	% Old Industrial	% Old Urban	% New Urban	% Open Space	% Other
Source Property Identification and Abatement	19.5	100.0	0	0	0	0
Green Infrastructure and Treatment	216.7	3.2	34.1	2.7	59.9	0
Large Full Trash Capture Devices	0	0	0	0	0	0
Enhanced O&M Measures[1]	1,158.8	1.6	85.1	2.7	10.2	0.3

Notes:

1. Includes enhanced street sweeping and inlet-based full trash capture device clean out.

19.2 Scope and Schedule of PCBs Control Measures

19.2.1 Source Property Identification and Abatement

The Fass Metals site was referred to the SFBRWQCB in FY 2017/18, although no load reduction credit has been taken for this source property due to the inability to implement enhanced O&M. A self-abatement report was submitted for a second site on Radiant Avenue in North Richmond.

Table 19-3: Unincorporated Contra Costa County Contaminated Sites Self-Abated or Referred to the SFBRWQCB (FY 2013/14 through FY 2019/20)

SITE NAME	LOCATION/APN	PROPERTY SIZE (ACRES)	YEAR	Referral/ Self-Abatement
Radiant Avenue	Radiant Avenue, North Richmond; 408-082-030	19.5	FY 2016/17	Self-Abatement
Fass Metals	818 West Gertrude Ave, Richmond	0.2	FY2017/18	Referral

Ongoing Investigations

Properties designated as High Likelihood or old industrial in Contra Costa County will be further investigated to see if they are properties likely to have PCBs. Contra Costa County will work with

County C.4 industrial inspectors under the Commercial and Industrial Inspection Program to investigate the likelihood of PCBs on these High Likelihood Properties. These investigations will be coordinated with industrial facility inspections over the next few years. Ongoing investigations may result in a property referral in the future.

19.2.2 Green Infrastructure / Treatment Control Measures

Any development, redevelopment, and infrastructure projects within each of the W/MAs will be subject to the development standards in effect at the time an application would be made, such as demolition standards and applicable provisions of section C.3. See the Contra Costa County's Green Infrastructure Plan for further information

19.2.3 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

The Program and Permittees actively participated in a BASMAA Regional Project to address PCBs in building materials as described in Section 2.3.1. Contra Costa County's Building Inspector Management participated on the Regional Project Technical Advisory Committee. The County began implementing a PCBs in Building Materials Program on July 1, 2019.

Managing PCBs in Infrastructure

The Program and Permittees participated in the BASMAA Regional Project to address PCBs in infrastructure as described in Section 2.3.2.

19.2.4 Enhanced Operation and Maintenance Control Measures

Enhanced O&M control measures that have been implemented by Contra Costa County include clean out of inlet-based full trash capture devices on a semi-annual basis. Some units were initially installed in 2013, including a total of 139 connector pipe screens and top hats. The County installed an additional 147 connector pipe screens in FY 2016/17 in the unincorporated communities of Bay Point, Richmond, and Rodeo. These systems are maintained to reduce not only debris but accumulated sediment from flowing to the Bay. They treat a total of 383.5 acres. Additional systems were installed in sections of North Richmond and Bay Point during FY 2018/19. As of the close of FY 2021/22, the County has installed a total of 463 full trash capture devices that treat 1,153 acres.

In addition, Contra Costa County began implementing enhanced street sweeping in FY 2015/16 as listed in Table 19-4 below.

Table 19-4: Unincorporated Contra Costa County Enhanced O&M Control Measures (FY 2013/14 through FY 2021/22)

Enhanced O&M Control Measure Type	Baseline Frequency	Enhanced Frequency	New Treatment Area (acres)	Location
Street Sweeping	Monthly	Biweekly	55.0	Crockett Commercial
Street Sweeping	Monthly	Biweekly	27.5	El Sobrante Commercial (excluding San Pablo Dam Road)
Street Sweeping	Monthly	Biweekly	13.4	El Sobrante Commercial (only including San Pablo Dam Road)
Street Sweeping	Monthly	Biweekly	19.5	Pacheco Commercial
Street Sweeping	Monthly	Biweekly	32.7	Richmond Pkwy
Street Sweeping	Monthly	Biweekly	83.3	Rodeo Commercial
Street Sweeping	Monthly	Biweekly	17.8	San Pablo Ave Commercial

Several areas of the County have roadside ditches and other areas have curb and gutter or curb and gutter interspersed with roadside ditches. As development takes place over time, Contra Costa County will develop curb and gutter and storm drain systems in some areas of the County, particularly in residential areas adjacent or near to old industrial areas. Contra Costa County Public Works Maintenance operates and maintains storm drain infrastructure by cleaning and repairing it to reduce debris and sediment that flows the Bay.

Contra Costa County has street sweeping in most areas that have curb and gutter. In some of the old urban and old industrial areas that have curb and gutter and storm drain infrastructure, Contra Costa County has enhanced the street sweeping frequency from once to twice per month. These areas include approximately 249 acres of commercial and some residential areas in the unincorporated areas of Crockett, Pacheco, Richmond, and Rodeo. These areas include old industrial, old urban, new urban and open space.

19.2.5 Diversion to POTW

Contra Costa County maintains the North Richmond pump station in North Richmond. A temporary diversion was planned under MRP 1.0. The diversion provided an opportunity to coordinate more with West County Wastewater District, test how a diversion could work, and discuss potential future diversions. Contra Costa County is investigating the possibility of building more permanent diversion infrastructure and coordinating with West County Wastewater District to potentially find a way to divert more stormwater drainage discharges.

19.2.6 Source Controls and Other Control Measures

Mercury Load Avoidance and Reduction

The Permittees are actively implementing mercury recycling programs in all W/MAs in order to reduce mercury loading to the Bay.

Household hazardous waste facilities collect materials and devices containing mercury. There may be other opportunities over time to collect mercury or identify additional sources and take measures to reduce discharges to the MS4. Contra Costa County's Landscaping and Lighting District has coordinated with PG&E to replace mercury-containing light fixtures with LED fixtures. As a result, Contra Costa County has converted all of its mercury and/or high-pressure sodium vapor street lights to Light Emitting Diode (LED) street lights. In addition, the County Public Works Department had also converted all fluorescent bulbs in the main office building to LED.

Illegal Dumping Cleanup

Illegal dumps are cleaned from Contra Costa County's road right-of-way regularly and disposed of properly by Contra Costa County's Public Works or where appropriate, Hazardous Materials. Illegal dumping consists of many types of material including furniture, trash, construction material and debris, and potentially hazardous materials or wastes. Where possible, information is used to track down the owner of the material and properly dispose of the material or recover costs of disposing.

The County will identify and cleanup illegal dumping of construction and demolition debris where illegal dumping of construction and demolition debris occurs.

Stockpiles, Spills, and Disposal of PCBs

Stockpiles and spills of PCBs will be addressed as they are identified through industrial facility inspection and spill notification programs.

Spills of PCBs occur due to accidents, weather, worn out transformers, or other reasons. The County may also find or be notified about stockpiles of materials. The County has trained Hazardous Materials and Environmental Health Inspectors on the importance of the identification and correct disposal of PCBs related to stormwater and the Municipal Regional Stormwater Permit (MRP 2.0). The County Watershed Program coordinates with Haz Mat to complete stormwater inspections and has communicated the importance of relaying information relating to PCBs sources to the Watershed Program. The County has also been involved in a Code Enforcement Task Force and has communicated the importance of working with stormwater managers to identify and communicate the potential presence of PCBs when there are spills or stockpiled material. The County works with the Contra Costa County Hazardous Materials staff and the Clean Water Program to inform program staff of spill incidents within unincorporated County. Where these spills involve other agencies or organizations, Contra Costa County will work with the agencies or property owners as appropriate.

20 LOADS REDUCED

This section presents estimates of the loads reduced by the control measures that are reported in the preceding sections of this report (Sections 3 through 22) for each Permittee and county-wide for FY 2013/14 through FY 2021/22. The loads reduced reported in this section reflect previous fiscal years' reporting, although previously reported load reductions may have been revised.

20.1 Loads Reduced – PCBs

Table 20-1 reports the estimated PCBs loads reduced for each Permittee for all control measures. Note that this table reflects the load reduction achieved through implementation of the program and protocol for managing materials with PCBs concentrations of 50 ppm or greater in applicable structures at the time such structures undergo demolition. This load reduction is equivalent to 373.3 g/yr, which has been allocated to each Permittee in FY 2018/19 based on their population in the year 2000.

Table 20-2 reports the PCBs loads reduced for all Permittees for each control measure. The results indicate that the load reductions required through Green Infrastructure by June 30, 2020 (23 g/yr) and the overall load reductions required by June 30, 2020 (560 g/yr) by the Contra Costa Permittees was exceeded.

Table 20-1: PCBs Loads Reduced by the Permittees (FY 2013/14 through FY 2021/22)

Permittee	PCBs Loads Reduced (g/yr)									
	FY2013-2014	FY2014-2015	FY2015-2016	FY2016-2017	FY2017-2018	FY2018-2019	FY2019-2020	FY2020-2021	FY2021-2022	Cumulative Load Reduced
Clayton	0	0.36	0.01	0	0	4.11	0	0	0	4.48
Concord	0.03	0.95	0.26	0.46	1.60	56.81	0	0.55	0.02	60.68
Danville	0.08	0.21	0.26	0.14	0.13	15.20	0.29	0.17	0.33	16.81
El Cerrito	0	0.16	0.05	0.24	0.05	11.19	0	0.03	0	11.72
Hercules	0	1.40	0	0	0.01	9.45	0	0	0	10.86
Lafayette	0.04	0.05	0.04	0	0.04	11.99	0.01	0.11	0	12.28
Martinez	0	0.40	0.05	0.97	0.07	14.07	0.14	0	0.04	15.74
Moraga	0.16	0.06	0	0.17	0.02	4.88	0	0	0	5.29
Orinda	0.39	0.01	0	0.05	0.03	6.82	0	0	0	7.30
Pinole	0.02	0.34	0	0.10	0.11	8.26	0.01	0	0	8.84
Pittsburg	0.54	1.34	12.26	0.31	0.10	23.10	0	0.02	0.94	38.61
Pleasant Hill	0.04	0.74	0.87	0.01	0	16.18	0	0	0	17.84
Richmond	0.29	7.23	0.85	2.71	70.62	61.49	0.79	1.27	0	145.25
San Pablo	0	0.20	18.52	0.08	0.22	14.65	0.01	0.30	0.02	34.00
San Ramon	0	0.17	0	0	0.08	17.30	0	0.22	0	17.77
Walnut Creek	0.23	1.17	0.11	0.39	0.13	29.70	0.62	0.53	0.07	32.95
Unincorporated County	0.44	0.07	0.48	79.29	0.19	86.92	0.77	0.03	0.33	168.52
TOTAL - All Permittees	**2.2**	**14.9**	**33.8**	**84.9**	**73.4**	**392.1**	**2.6**	**3.2**	**1.8**	**608.9**

Note: Control measure implementation data may be incomplete for FY 2021/22.

Table 20-2: PCBs Loads Reduced Within Contra Costa County (FY 2013/14 through FY 2021/22)

Control Measure Category	PCBs Loads Reduced (g/yr)										Required Load Reductions 6/30/2020 (g/yr)
	FY 2013-2014	FY 2014-2015	FY 2015-2016	FY 2016-2017	FY 2017-2018	FY 2018-2019	FY 2019-2020	FY 2020-2021	FY 2021-2022	Cumulative Load Reduced	
Source Property Identification and Abatement[1]	0	0	30.06	78.68	63.23	0	0	0	0	171.97	--
Green Infrastructure and Treatment	2.24	8.53	3.41	4.29	3.21	9.48	2.46	2.42	1.69	37.73	**23.00**
Large Full Trash Capture Devices	0	4.41	0.03	0	6.53	9.08	0	0.81	0.00	20.86	--
Enhanced O&M	0	1.90	0.25	1.95	0.44	0.24	0.18	0.01	0.06	5.03	--
Manage PCBs in Building Materials	0	0	0	0	0	373.33	0	0	0.	373.33	--
Diversion to POTW	0	0	0	0	0	0	0	0	0	0.	--
Source Controls/ Other	0	0	0	0	0	0	0	0	0	0	--
TOTAL - All Control Measures	**2.2**	**14.9**	**33.8**	**84.9**	**73.4**	**392.1**	**2.6**	**3.2**	**1.8**	**608.9**	

Notes:

1. Load Reduced = (Source Property Area (ac)) x (4.065 – 0.0303 (g/ac/yr)). Acres associated with this control measure can be found in each Permittee section of this report.
2. For parcel-based projects, Load Reduced = (Project Area (ac)) x (Existing Yield – 0.0035 (g/ac/yr)). For green street or regional retrofit projects, Load Reduced = (Project Drainage Area (ac)) x (area-weighted PCBs yield (g/ac/yr)) x 0.70. Acres associated with this control measure can be found in each Permittee section of this report.
3. Load Reduced = (Project Drainage Area (ac)) x (area-weighted PCBs yield (g/ac/yr)) x 0.20. Acres associated with this control measure can be found in each Permittee section of this report.

"--" indicates no required load reduction target or loads reduced.

20.2 Loads Reduced – Mercury

Table 20-3 and Table 20-4 report the estimated mercury loads reduced for each Permittee and county-wide, respectively. The mercury load performance criterion via green infrastructure implementation for Contra Costa County is 9 g/yr by June 30, 2020; the results in Table 20-4 indicate that this performance criterion was exceeded.

Note that these estimated load reductions do not account for loads reduced by the Mercury Load Avoidance and Reduction source control measure. CCCWP will continue to annually compile and report the number of mercury-containing products collected at household hazardous waste facilities. Translation of that collection information to loads reduced from urban stormwater discharges is challenging and may not be necessary to show attainment of the mercury load reduction goals.

Table 20-3: Mercury Loads Reduced by the Permittees (FY 2013/14 through FY 2021/22)

Permittee	Mercury Loads Reduced (g/yr)									
	FY2013-2014	FY2014-2015	FY2015-2016	FY2016-2017	FY2017-2018	FY2018-2019	FY2019-2020	FY2020-2021	FY2021-2022	Cumulative Load Reduced
Clayton	0	2.47	0.06	0	0	0	0	0	0	2.53
Concord	0.17	9.16	3.16	3.33	10.95	0.97	0.03	7.47	0.20	35.44
Danville	0.57	1.46	1.69	0.32	0.89	0.47	1.96	1.13	0.02	8.51
El Cerrito	0	1.16	0.40	1.75	0.38	0.81	0	0.23	0.01	4.74
Hercules	0	17.42	0	0	0.05	14.22	0	0	0	31.69
Lafayette	0.30	0.35	0.24	0	0.27	1.65	0.05	0.76	0	3.62
Martinez	0	5.85	0.57	11.31	0.05	1.58	0.90	0.01	0.32	20.59
Moraga	1.07	0.46	0.00	1.92	0.11	0.17	0	0	0	3.73
Orinda	2.65	0.06	0.00	0.33	0.03	0.06	0	0.02	0	3.15
Pinole	0.12	4.18	0.00	0.63	0.76	1.99	0.09	0	0	7.77
Pittsburg	4.45	10.40	5.58	1.96	0.71	23.58	0.01	0.15	13.83	60.67
Pleasant Hill	0.26	5.24	5.88	0.10	0	6.92	0	0	0	18.40
Richmond	2.86	102.19	9.46	25.06	87.93	122.91	11.37	12.99	0	374.77
San Pablo	0	1.55	11.44	0.53	1.67	0.09	0.09	2.05	0.14	17.56
San Ramon	0	1.19	0	0	0.56	0.36	0	0	0	2.11
Walnut Creek	2.74	8.08	0.72	2.60	0.84	5.66	4.17	3.61	0.45	28.87
Unincorporated County	2.98	0.45	1.78	25.30	1.26	4.29	9.32	0.03	2.25	47.66
TOTAL - All Control Measures	**18.2**	**171.7**	**41.0**	**75.1**	**106.5**	**185.7**	**28.0**	**28.4**	**17.2**	**671.8**

Note: Control measure implementation data may be incomplete for FY 2021/22.

Table 20-4: Mercury Loads Reduced Within Contra Costa County (FY 2013/14 through FY 2021/22)

Control Measure Category	Mercury Loads Reduced (g/yr)									
	FY2013-2014	FY2014-2015	FY2015-2016	FY2016-2017	FY2017-2018	FY2018-2019	FY2019-2020	FY2020-2021	FY2021-2022	Cumulative Load Reduced
Source Property Identification and Abatement[1]	0	0	8.08	21.16	17.00	0	0	0	0	46.24
Green Infrastructure and Treatment[2]	18.18	115.45	32.29	38.41	28.39	112.80	26.68	20.68	16.73	409.61
Large Full Trash Capture Devices[3]	0	42.37	0.43	0.01	58.40	70.96	0	7.54	0	179.71
Enhanced O&M Measures[4]	0	13.86	0.21	15.57	2.66	2.00	1.31	0.19	0.50	36.30
Diversion to POTW	0	0	0	0	0	0	0	0	0	0
Source Controls/ Other[4]	--	--	--	--	--		0	0	0	0
TOTAL - All Permittees	**18.2**	**171.7**	**41.0**	**75.1**	**106.5**	**185.7**	**28.0**	**28.4**	**17.2**	**671.8**

Notes:

1. Load Reduced = (Source Property Area (ac)) x (4.065 – 0.0303 (g/ac/yr)). Acres associated with this control measure can be found in each Permittee section of this report.
2. For parcel-based projects, Load Reduced = (Project Area (ac)) x (Existing Yield – 0.0035 (g/ac/yr)). For green street or regional retrofit projects, Load Reduced = (Project Drainage Area (ac)) x (area-weighted PCBs yield (g/ac/yr)) x 0.70. Acres associated with this control measure can be found in each Permittee section of this report. The Mercury Load Performance Criteria via Green Infrastructure Implementation for Contra Costa County is 9 g/yr by June 30, 2020.
3. Load Reduced = (Project Drainage Area (ac)) x (area-weighted PCBs yield (g/ac/yr)) x 0.20. Acres associated with this control measure can be found in each Permittee section of this report.
4. See individual Permittee sections for how loads were estimated.
5. “--" indicates no required load reduction target.

21 REFERENCES

BASMAA, 2017. Interim Accounting Methodology for TMDL Loads Reduced, Version 1.1. Prepared by Geosyntec Consultants and EOA, Inc. for the Bay Area Stormwater Management Agencies Association (BASMAA). March 2017.

Contra Costa Clean Water Program, 2016. Mercury and PCBs Control Measures Implementation Status Report. Submitted in Compliance with Provision C.11.a.iii.(1) and C.12.a.iii.(1) Municipal Regional Stormwater Permit NPDES Permit No. CAS612008 Order No. R2-2015-0049. March 31, 2016.

Mangarella, P., Havens, K., Lewis, W., and McKee, L.J., 2010. Task 3.5.1: Desktop Evaluation of Controls for Polychlorinated Biphenyls and Mercury Load Reduction. A Technical Report of the Regional Watershed Program: SFEI Contribution 613. San Francisco Estuary Institute, Oakland, CA.

McKee, L., Mangarella, P., Williamson, B., Hayworth, J., and Austin, L., 2006. Review of Methods Used to Reduce Urban Stormwater Loads: Task 3.4. A Technical Report of the Regional Watershed Program: SFEI Contribution #429. San Francisco Estuary Institute, Oakland, CA.

Yee, D., McKee, L.J., 2010. Task 3.5: Concentrations of PCBs and Mercury in Soils, Sediments, and Water in the Urbanized Bay Area: Implications for Best Management. A Technical Report of the Watershed Program. SFEI Contribution 608. San Francisco Estuary Institute, Oakland, CA 94621.

Attachment 11.2

Source Control Load Reduction Accounting for Reasonable Assurance Analysis

Update 2022

SOURCE CONTROL LOAD REDUCTION ACCOUNTING

FOR REASONABLE ASSURANCE ANALYSIS

Prepared for

Bay Area Stormwater Management Agencies Association

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Project Number: LA0499

January 21, 2022

Version 1.1

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ACRONYMS AND ABBREVIATIONS

ACCWP	Alameda Countywide Clean Water Program
BASMAA	Bay Area Stormwater Management Agencies Association
CCCWP	Contra Costa Clean Water Program
GSI	Green Stormwater Infrastructure
GIS	Geographic Information System
IMR	Integrated Monitoring Report
mg/ac/yr	milligram per acre per year
mg/kg	milligram per kilogram
MPC	Monitoring and Pollutants of Concern Committee
MRP	Municipal Regional Permit
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
O&M	Operation and Maintenance
OFEE	Oil-Filled Electrical Equipment
PCBs	Polychlorinated Biphenyls
PG&E	Pacific Gas and Electric Company
POC	Pollutants of Concern
POTW	Publically Owned Treatment Works
RAA	Reasonable Assurance Analysis
SCVURPPP	Santa Clara Valley Urban Runoff Pollution Prevention Program
SFEI	San Francisco Estuary Institute
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board
SMCWPPP	San Mateo Countywide Water Pollution Prevention Program
TMDL	Total Maximum Daily Load
WY	Water Year

1. INTRODUCTION

1.1 Background

Municipal Regional Permit (MRP; SFBRWQCB, 2015[1]) Provisions C.11.b and C.12.b required the Permittees to develop and implement an assessment methodology and data collection program to quantify mercury and polychlorinated biphenyls (PCBs) loads reduced through implementation of pollution prevention, source control, and treatment control measures in 2016. BASMAA prepared the report *Interim Accounting Methodology for TMDL Loads Reduced* (BASMAA, 2017a), which was approved by the Water Board for use during the MRP permit term from January 1, 2016 through June 30, 2022 (known as "MRP 2.0"). The Permittees have used this assessment methodology to demonstrate progress towards achieving the load reductions required in MRP 2.0. This report has been prepared to address the requirements of MRP 2.0 Provisions C.11.b.iii.(3) and C.12.b.iii.(3), which require the Permittees to submit, for Executive Officer approval, refinements to the Interim Accounting Methodology to assess mercury and PCBs load reductions in the next permit term (i.e., MRP 3.0).

MRP 2.0 Provisions C.11.d. and C.12.d. required the Permittees to prepare plans and schedules for mercury and PCBs control measure implementation and a reasonable assurance analysis (RAA) demonstrating that those control measures will be sufficient to attain the mercury total maximum daily load (TMDL) wasteload allocations by 2028 and the PCBs TMDL wasteload allocations by 2030. The *Bay Area RAA Guidance Document* (BASMAA, 2017b) establishes a regional framework and guidance for conducting RAAs in the Bay Area, including the types of modeling and data inputs that may be used by the Programs and Permittees for estimating loads reduced by green stormwater infrastructure (GSI). Section 4.2 of the *Bay Area RAA Guidance Document* states that load reductions for source control measures should be calculated based on methods provided in an approved refinement of the *Interim Accounting Methodology for TMDL Loads Reduced* (BASMAA, 2017a). This report refines the Interim Accounting Methodology for the purposes of source control load reduction accounting in the RAAs and during MRP 3.0.

This document does not describe the methods used to predict the loads reduced through the implementation of GSI in the RAAs. The RAA methodologies for GSI are described in the countywide RAA reports that were submitted to the SFBRWQCB in September 2020 (ACCWP, 2020; CCCWP, 2020; FSURMP, 2020; SMCWPPP, 2020; and SCRURPPP, 2020). The accounting that will be used for assessing compliance with MRP 3.0 Provision C.12.c, Program for Treatment Control Measures in Old Industrial Areas, is provided in this document.

1.2 Report Overview

The load reduction accounting methodologies are presented in Sections 2 through 10 of this document for the following mercury and PCBs source control measure programs:

- Source Property Identification and Abatement;

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[1] Reissued November 19, 2015 with effective date January 1, 2016, to 77 Phase I municipal stormwater Permittees in five Bay Area counties which are among over 90 local agencies comprising the Bay Area Stormwater Management Agencies Association (BASMAA).

- Treatment Control Measures in Old Industrial Areas, including
  - Treatment control measures,
  - Trash Full Capture Systems Implementation,
  - Enhanced Operations and Maintenance Control Measures, and
  - Diversion to Publicly Owned Treatment Works (POTW);
- Management of PCBs in Stormwater Infrastructure;
- Management of PCBs in Electrical Utilities;
- Management of PCBs-Containing Materials and Wastes During Building Demolition; and
- Mercury Load Avoidance and Reduction.

The appendices present:

- A summary of how the land used-based PCBs and mercury yields were developed;
- A statistical summary of the observed urban sediment concentrations;
- Large, non-inlet-based trash capture device efficiency factor data analysis;
- Enhanced inlet cleaning efficiency factor data analysis for storm drain inlets with and without inlet-based full trash capture devices;
- Enhanced street sweeping efficiency factors;
- An estimate of load reductions for the Management of PCBs in Stormwater Infrastructure Program; and
- A summary of the analysis that was conducted to develop the data inputs for use in the accounting method for the PCBs in Electrical Utilities Management Program.

1.3 Source Control Load Reduction Accounting Basis

The source control load reduction accounting methodology outlined in this report is based on relative mercury and PCBs yields from different land use categories. This methodology was first outlined in the 2014 Integrated Monitoring Reports (IMRs) (ACCWP, 2014; CCCWP, 2014; SCVURPPP, 2014; SMCWPPP, 2014) and was described in the MRP 2.0 Fact Sheet. The method involves using default factors for PCBs and mercury load reduction credits resulting from foreseeable control measures. This report updates and refines the accounting system to account for new information; justifies the assumptions, analytical methods, sampling schemes, and parameters used to quantify the load reduction for each type of control measure; and indicates what information will be collected and submitted to confirm the calculated load reduction for each unit of activity for each control measure.

As described in the MRP 2.0 Fact Sheet, a land use-based yield is an estimate of the mass of a contaminant contributed by an area of a particular land use per unit time. Essentially, different types of land uses yield different amounts of pollutants because land use types differ in their degree of contamination resulting from differing intensities of historic or ongoing use of pollutants. The land use categories used to calculate land use-based yields were identified from studies conducted to identify potential POC sources and source areas, as described below.

The Regional Watershed Spreadsheet Model (RWSM) was developed as part of the Regional Monitoring Program's Small Tributaries Loading Strategy as a regional-scale planning tool primarily for the purpose of estimating long-term average annual pollutant loads from the small tributaries surrounding San Francisco Bay, and secondarily to provide supporting information for prioritizing watersheds or areas within watersheds for management actions (Wu et al, 2016). The RWSM is structured with three stand-alone empirical models: the hydrology model, sediment model, and pollutant models. The hydrology model uses runoff coefficients based on land use-soil-slope combinations to estimate annual runoff from a watershed. The sediment model uses a function of geology, slope, and land-use to simulate suspended sediment transport in the landscape while adjusting for watershed storage factors. The pollutant model is essentially a "concentration map" that can be driven by either the hydrology model (for pollutant concentrations in water) or the sediment model (for pollutant concentrations on fine sediment particles as particle ratios[2] for specific land use or source areas). Starting in 2010, a multi-year effort was undertaken to systematically develop and calibrate the RWSM. Calibration was completed[3] and the model was released in 2018.

A PCBs source property yield was derived as the product of a representative PCBs concentration in shallow surface soils at known source properties and a representative soil/sediment yield for Old Industrial land use areas. The derivation of the estimated PCBs source property yield is described in Appendix A.

PCBs were more heavily used in older industrial areas so older industrial land use areas yield a much higher mass of PCBs per unit area than newer urban land use areas. The estimated average PCBs and mercury yields from the RWSM are summarized for six land use yield categories in Table 1-1 below. These yields are assigned based on land use but may also be assigned by the Permittees based on monitoring data and/or inspection results (e.g., to assign the Source Property yield to a parcel mapped as Old Industrial). These yield values have been developed using the best available data and technical approach at this time. The Permittees may re-evaluate these yields in the future as more information becomes available.

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[2] Particle ratios = pollutant concentration in water (ng/L) / suspended sediment concentration (mg/L), equivalent to mg/kg.
[3] The calibration for PCBs is "reasonable" but there remains a lower confidence in the calibration for mercury (SFEI, 2017).

Table 1-1: Land Use-Based Yields for PCBs and Mercury

Land Use Category	Assumed Average PCBs Yield (mg/ac/yr)	Assumed Average Mercury Yield[1] (mg/ac/yr)
Source Property	5,078	53
Old Industrial	259	53
Old Commercial / Old Transportation	49	57
Old Residential	2.8	57
New Urban	0.4	4
Agriculture/Open Space	0.4	81

mg/ac/yr – milligrams per acre per year
Source: RWSM Toolbox v1.0 Pollutant Model, Pollutant Spreadsheet Model Calculations – Region. Spreadsheet dated 6/9/2017.
1. The model calibration for PCBs is "reasonable" but there remains a lower confidence in the calibration for mercury (Wu et al., 2017).

Appendix B presents concentration statistics for PCBs and mercury observed in street, storm drain, and private property sediment samples collected by BASMAA from 1999 through 2019. The data are summarized by the predominant land use within the vicinity of where the sediment was collected.

2. PROGRAM FOR SOURCE AREA IDENTIFICATION AND ABATEMENT

2.1 Program Description

The Source Area Identification and Abatement Program involves investigations of properties located in historically industrial land use or other land use areas where PCBs were used, released, and/or disposed of and/or where sediment concentrations are significantly elevated above urban background levels[4] and are being transported to the municipal separate storm sewer system (MS4). Once a source property is identified, the source of PCBs on the property may be abated or caused to be abated directly by the Permittee or the Permittee may choose to refer the source property to the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) for investigation and abatement by the SFBRWQCB.

2.2 Loads Reduced Accounting Methodology

The amount of PCBs loads (i.e., annual mass or milligrams per year (mg/yr)) reduced will be assessed for source properties using the following accounting method:

$$Load\ of\ PCBs\ Reduced = SP_A \bullet (SP_Y - OCOT_Y)$$

Where:

SP_A	=	Source property area (acres (ac))
SP_Y	=	Source property PCBs yield (mg/ac/yr)
$OCOT_Y$	=	Old Commercial/Old Transportation land use PCBs yield (mg/ac/yr)

Thus, the PCBs load reduced in mg/yr will be calculated as the area of the source property in acres multiplied by 5,029 mg/ac/yr (i.e., 5,078 – 49 mg/ac/yr).

There is no mercury load reduction credit given to PCBs source property referrals, as there is not a significant difference between the estimated source property, old industrial, old residential, and old commercial/old transportation mercury yield values.

Fifty percent of this load reduction will be credited to the Permittee for properties that are referred to the SFBRWQCB for abatement at the time of referral provided that enhanced O&M measures or stormwater treatment are implemented or caused to be implemented in the vicinity of the referred source property to prevent further contaminated sediment from being discharged from the storm drain system. The remaining 50% load reduction for referred properties will be credited to the Permittee upon completion of the abatement process or at ten years, whichever occurs first. The SFBRWQCB will notify the Permittee when the abatement process is complete.

If a source property has been abated without referral to the SFBRWQCB, either through voluntary actions by the property owner or the use of municipal enforcement powers, then all of the load reduction calculated using the methodology above will be credited to the Permittee at

[4] See Appendix B for a statistical summary of urban sediment concentrations.

the time that the abatement is complete. The Permittee shall provide documentation to the SFBRWQCB that abatement has effectively eliminated the transport of PCBs or mercury to the MS4 or directly to the Bay for all transport mechanisms that apply to the site (e.g., stormwater runoff, wind, vehicle tracking). The documentation shall include information on the type and extent of abatement that has occurred (e.g., have the sources of PCBs to the MS4 been eliminated via soil removal, capping, paving, walls, plugging/removal of internal storm drains, etc.). Documentation may be from a cleanup regulatory agency such as the US Environmental Protection Agency (USEPA) or the California Department of Toxic Substances Control (DTSC). For sites with ongoing industrial activities, water or sediment monitoring data that demonstrates the effective elimination of transport of PCBs offsite into the MS4 or to the Bay should be provided.

For source properties that include a combination of industrial area and area that is not likely to be a source of PCBs (e.g., unimpacted open space area), the source property yield will only be applied to the portion of the property that is an industrial area.

3. PROGRAM FOR CONTROL MEASURES IN OLD INDUSTRIAL AREAS

3.1 Program Description

This program includes a variety of control measures that may be implemented to reduce loads of PCBs and mercury within old industrial areas, known or suspected source areas, or areas with evidence of moderate to high PCBs soil concentrations (generally soil/sediment concentrations greater than 0.2 mg PCBs/kg) pursuant to MRP 3.0 Provision C.12.c. These control measure include:

- Implementation of GSI through new development and redevelopment activities and retrofit of treatment controls (including GSI) into existing developed areas on private and public properties and within the public right-of-way,
- Full trash capture systems,
- Diversion to publicly owned treatment works (POTW),
- Enhanced operations and maintenance, and
- Other control measures.

3.2 Loads Reduced Accounting Methodology

The following load reduction accounting methodologies will be used to calculate the PCBs and mercury loads reduced by control measures implemented under MRP 3.0 Provisions C.11.c and C.12.c.

3.2.1 Parcel-Based Redevelopment or Retrofit Projects

When contaminated areas are redeveloped or retrofit[5], the pollutant yield of the area will be reduced through a variety of mechanisms (i.e., removal, capping, or paving of contaminated sediment and treatment of the post-development runoff). The amount of PCBs and mercury load reduction can be obtained by multiplying the area of the project by the difference in land use-based yield (either Old Industrial minus New Urban or Old Urban minus New Urban, whichever pre-development land use is applicable).

The Permittees will quantify and report the amount of PCBs and mercury loads reduced from implementation of post-development treatment measures (as well as land use change and abatement) for redevelopment and parcel-based retrofit projects using the following accounting method:

$$Load\ of\ POC\ Reduced = P_A \bullet (P_Y - NU_Y)$$

Where:

P_A = New development/redevelopment/parcel-based retrofit project area (ac)

[5] These projects provide treatment control for existing developed areas without redeveloping the tributary area.

P_Y = Existing PCBs or mercury yield (mg/ac/yr)

NU_Y = New Urban PCBs or mercury yield (mg/ac/yr)

3.2.2 Green Street Projects, Regional Retrofit Projects, Large Full Trash Capture Devices, and Diversion to POTW

The Permittees will quantify and report the amount of PCBs and mercury loads reduced from implementation of green street projects, regional retrofit projects, large (non-inlet based) full trash capture devices (i.e., hydrodynamic separators (HDS) units, gross solids removal devices (GSRDs), and baffle boxes), and diversion to POTW using the following accounting method:

$$Annual\ Mass\ of\ PCB\ Reduced = P_A \bullet P_Y \bullet E_f$$

Where:

P_A = Tributary area treated by stormwater green infrastructure/retrofit treatment measure (acres)

P_Y = Area-weighted PCBs or mercury yield (mg/acre/year)

E_f = Efficiency factor for green infrastructure/retrofit treatment control measures (assumed to be 70%)[6], large full trash capture devices (assumed to be 20%)[7], or diversion to POTW (assumed to be 91%)[8]

3.2.3 Enhanced Operations and Maintenance Activities

Routine MS4 operation and maintenance (O&M) activities include street sweeping, drain inlet cleaning, and pump station maintenance. In addition, culverts and channels are also routinely maintained (i.e., desilted). Enhancements to routine operations and new actions such as storm drain line and street flushing may enhance the Permittees' ability to reduce PCBs and mercury in stormwater.

Enhanced Inlet Cleaning (With and Without Small Full Trash Capture Devices) and Street Sweeping

Load reductions for enhanced inlet cleaning and street sweeping will be calculated as follows:

$$\boldsymbol{Annual\ Load\ of\ PCB\ Reduced = P_A \bullet P_Y \bullet EE_f}$$

Where:

P_A = Catchment area for enhanced O&M measure (acres)

P_Y = Area-weighted PCBs yield (mg/acre-year) for the enhanced O&M catchment area based on land use yield

6 BASMAA, 2014.
7 See Appendix C for large trash capture device unit efficiency factor data analysis.
8 SFBRWQCB, 2021.

EE_f	=	Enhancement Efficiency factor for enhanced O&M control measure (See Appendix D for enhanced inlet cleaning with and without small full trash capture devices and Appendix E for enhanced street sweeping).

Pump Station Cleanout, Storm Drain Line Cleanout, Street Flushing, and Culvert/Channel Desilting

Load reductions for enhanced pump station cleanout, storm drain line cleanout, street flushing, and culvert/channel desilting will be calculated as follows:

$$Enhanced_{LR} = Current_{LR} - Baseline_{LR}$$

Where:

$Current_{LR}$	=	$Vol_{Current} \bullet \%Sed \bullet \rho \bullet Conc$
$Baseline_{LR}$	=	$Vol_{Baseline} \bullet \%Sed \bullet \rho \bullet Conc$
$Vol_{Current}$	=	Average volume of material collected via the enhanced O&M control measure in current year(s) (post-Fiscal Year 2001-02) (m^3/yr)
$Vol_{Baseline}$	=	Average volume of material collected via the O&M control measure in baseline years (prior to and including Fiscal Year 2001-02) (m^3/yr) (assumed to be zero for storm drain line cleanout and street flushing)
%Sed	=	Percent of material collected (by volume) by the enhanced O&M control measure that is sediment < 2mm in diameter (measured)
ρ	=	Sediment density of the material collected by the enhanced O&M control measure (weight per unit volume) (measured)
Conc	=	Average concentration of PCBs in sediments collected by the enhanced O&M control measure (mg/kg; see Appendix B for land use-based sediment concentrations to calculate area-weighted concentrations or alternatively use project-specific measurements).

3.2.4 Other Control Measures

Properties with elevated levels of PCBs or mercury that are not source properties (i.e., old industrial properties or properties with evidence of moderate to high PCBs soil concentrations (generally soil/sediment concentrations greater than 0.2 mg PCBs/kg)) may be abated through voluntary actions by the property owner or the use of municipal enforcement powers. The abatement should effectively eliminate the transport of PCBs or mercury to the MS4 or directly to the Bay for all transport mechanisms that apply to the site (e.g., stormwater runoff, wind, vehicle tracking). The Permittee should document the type and extent of abatement that has occurred (e.g., have the sources of PCBs to the MS4 been eliminated via soil removal, capping, paving, walls, plugging/removal of internal storm drains, etc.). For sites with ongoing industrial activities, water or sediment monitoring data that demonstrates the effective elimination of transport of PCBs offsite into the MS4 or to the Bay should be obtained.

The amount of PCBs loads reduced will be calculated for other control measures using the following accounting method:

$$Load\ of\ PCBs\ Reduced = P_A \bullet (OI_Y - OCOT_Y)$$

Where:

P_A	=	Property area (acres (ac))
OI_Y	=	Old Industrial PCBs yield (mg/ac/yr)
$OCOT_Y$	=	Old Commercial/Old Transportation land use PCBs yield (mg/ac/yr)

Thus, the PCBs load reduced in mg/yr will be calculated as the area of the controlled property in acres multiplied by 210 mg/ac/yr (i.e., 259 – 49 mg/ac/yr).

There is no mercury load reduction credit given to other control measures, as there is not a significant difference between the estimated old industrial and old commercial/old transportation mercury yield values.

4. PROGRAM FOR MANAGING PCBS IN STORMWATER INFRASTRUCTURE

4.1 Program Description

For this control measure, Permittees will track development of a Caltrans specification for managing PCBs-containing caulks and sealants on bridges or roadway overpasses during bridge replacement or joint maintenance. The Caltrans standard specifications for removal, handling, and disposal of caulk or sealant materials during infrastructure replacement or joint maintenance projects will be used to prevent the release of PCBs to the MS4. The Caltrans specification will be applied to all applicable public bridges or roadway overpass structures when the bridge infrastructure undergoes replacement or joint maintenance.

4.2 Loads Reduced Accounting Methodology

A detailed load reduction accounting methodology is provided in Appendix F and summarized here.

Total PCBs load contained in bridges built and/or reconstructed prior to 1981 within the jurisdictions subject to the MRP was estimated using the following equation:

$$\text{Total Load}_{\text{PCBs, Bridges}} = \text{Density}_{\text{sealant}} * \text{Concentration}_{\text{PCBs}} * \sum \text{Volume}_{\text{sealant, bridges}}$$

Where:

$\text{Density}_{\text{sealant}}$ = average sealant density [kg/m^3]

$\text{Concentration}_{\text{PCBs}}$ = empirically derived concentration of PCBs [mg/kg]

$\sum\text{Volume}_{\text{sealant, bridges}}$ = Volume of sealant in all applicable bridges [m^3]

The volume of joint sealant was calculated using an assumed cross-section of sealant, multiplied by the assumed length of applied sealant:

$$\text{Volume}_{\text{sealant, bridges}} = \text{Cross-Section}_{\text{sealant}} * \text{Length}_{\text{sealant}}$$

Where:

$\text{Cross-Section}_{\text{sealant}}$ = Cross-section of applied sealant

$\text{Length}_{\text{sealant}}$ = Length of applied sealant

A summary of the data inputs is provided in Table 5-1 below. The derivation of the values presented in Table 5-1 is described in Appendix F.

Table 5-1: Bridge Load Calculation Data Inputs

Input	Result	Units	Source
Density of Sealant	1,100	kg/m^3	Takhar, 2013
Cross-Section of Sealant	1	square inch	Caltrans, 2007
PCBs Concentration	184	mg/kg	See Section 2.2.1

The estimated total PCBs load contained in bridges built and/or reconstructed prior to 1981 within the jurisdictions subject to the MRP is provided in Table 5-2.

Table 5-2: Total Calculated Loads for Bridges within the MRP Area, Built and/or Reconstructed Prior to 1981

County	Total Sealant PCBs Mass - Joints Only (kg)	Total Sealant PCBs Mass - Joints and Longitudinal Seal (kg)	Number of Bridges[1]
Alameda	3.8	11.2	340
Contra Costa	1.7	7.3	277
San Mateo	2.5	7.2	254
Santa Clara	3.7	10.1	473
Solano	0.9	3.2	133
Total	**12.6**	**39.0**	**1,477**

1. U.S. Department of Transportation Federal Highway Administration, 2019. National Bridge Inventory. Visited 24 March 2020.

To estimate the load reduction associated with long-term bridge or expansion joint replacement, it is assumed that an ongoing PCBs release rate from bridge joints is mitigated through bridge joint maintenance and whole bridge replacement projects. The load reduction estimation is based on the assumption that PCBs in caulk are leaching from bridge joints and longitudinal seals over their lifetime. When that PCBs-containing caulk is replaced or removed through maintenance or replacement projects, the source of PCBs release is removed, and the associated annual released load is also removed. PCBs leaching from the material could occur through incremental wear or through larger damage (e.g., pieces of caulk torn out) over the lifetime of the caulk.

Lacking a literature-based release rate of sealant over time, two potential average annual release rates (i.e., average over the life of the seal) were assumed to calculate an estimated load reduction from removing the joint seal –0.5% and 1.0%. These average annual release rates were applied to the estimated mass for the 1,477 bridges meeting the identified age criteria (Table 5-3). These releases would be eliminated through removal of the joint seal through joint replacement or bridge replacement.

Table 5-3: Long-Term Load Reduction (i.e., Replacement of PCBs-Containing Joints in All Older Bridges)

County	Total Sealant PCBs Load Reduced - Joints Only (g/year)		Total Sealant PCBs Load Reduced - Joints and Longitudinal Seal (g/year)	
	0.5% annual loss rate over life	1% annual loss rate over life	0.5% annual loss rate over life	1% annual loss rate over life
Alameda	19	38	56	112
Contra Costa	8	17	37	73
San Mateo	12	25	36	72
Santa Clara	19	37	50	101
Solano	5	9	16	32
Total	63	126	195	390

This load reduction would occur no later than 2080, based on the assumption that all older joints will be removed/replaced within 100 years of installation.

5. PROGRAM FOR MANAGING PCBS FROM ELECTRICAL UTILITIES

5.1 Program Description

The Electrical Utilities Management Program includes improved procedures for documenting removal and disposal of PCBs-containing electrical equipment (i.e., oil-filled electrical equipment, or OFEE) as part of ongoing equipment maintenance practices.

For this control measure, Permittee owned electrical utilities will document the removal of PCBs-containing OFEE since the start of the TMDL and in the future until all PCBs-containing OFEE have been removed from active service and provide data to support calculations of the associated stormwater load reductions due to these efforts. Additionally, it is anticipated that non-municipally owned regional electrical utilities that are not currently subject to PCBs load reduction requirements (i.e., PG&E) have been and will continue to remove PCBs-containing OFEE and document these efforts, past and present, consistent with methods used by applicable MRP permittees.

5.2 Loads Reduced Accounting Methodology

The load of PCBs reduced through implementation of the Electrical Utilities Management Program will be assessed using the following accounting method:

$$[1]\ Total\ Load\ of\ PCBs\ Reduced\ (LR_T) = \left[\sum_{i=1}^{n}(LR_i)\right]$$

Where:

LR_i = Load of PCBs reduced for PCBs-containing OFEE removal during year *i* (kg/yr).

The PCBs loads reduced each year will be assessed using the following equations:

$$[2]\quad Load\ of\ PCBs\ Entering\ MS4\ in\ Year\ i\ (L_i) = [L_0 \bullet (1-F)^x]$$

and

$$[3]\ Load\ of\ PCBs\ Reduced\ during\ year\ i\ (LR_i) = L_i \bullet F$$

Where:

L_i = Estimated annual load of PCBs entering the MS4 from OFEE in Year *i* (kg/yr).

L_0 = The initial annual load of PCBs that enters the MS4 from OFEE at the start of the PCBs TMDL (approximately 2005).

F = Estimated fraction of PCBs load prevented from entering the Bay each year due to OFEE removal (dimensionless fraction).

x = Number of years since the start of the PCBs TMDL (approximately 2005) and the year *i* (i.e., year *i* – 2005).

The above equations assume the fraction of PCBs load prevented from entering the MS4 each year is approximately equivalent to the annual OFEE removal rate.

Reasonable values were developed for each of the terms shown in equations [2] and [3] in order to calculate the total load reductions achieved for implementing the Electrical Utilities Management Program (Table 4-1, see Appendix G for further detail). The initial load of PCBs from OFEE at the start of the TMDL in approximately 2005 (L_0) was estimated as described in Appendix G as 1.1 kg/yr. This value is the TMDL-normalized annual load of PCBs that were entering the MS4 from OFEE in the San Francisco Bay area for data reported in McKee et al. (2006). The fraction of PCBs-containing OFEE removed annually (F) was estimated from data provided by municipally-owned electrical utilities in the MRP area. These data indicated that between 2005 and 2020, PCBs-containing OFEE were removed from service at a rate of 1.3% to 4.8% per year (average = 2.3% per year). These values are assumed to represent the range of annual OFEE removal rates since 2005 and into the future. The derivation of each of the terms shown in Table 4-1 is presented in detail in Appendix G. These values may be updated based on new data.

Table 4-1: Range of Values used to Estimate the PCBs Load Reductions due to the Electrical Utilities Management Program Since the Start of the PCBs TMDL in Approximately 2005.

Term	Description	Estimated Values	Units
L_0	Annual load of PCBs to MS4 from OFEE at the start of the PCBs TMDL; this value is assumed to be the TMDL-normalized McKee et al. (2006) estimated load to stormwater from transformers and large capacitors in 2005 (see Appendix G for details on how this value was developed).	1.1	kg/yr
F	Fraction of PCBs prevented from entering MS4 due to ongoing OFEE removals; these values are assumed equivalent to the annual rate of OFEE removal achieved by municipally owned electrical utilities in the Bay Area between 2005 and 2020 (see Appendix G for details on how these values were developed).	1.3 - 4.8 (Average=2.3)	%/year

Using the inputs provided in Table 4-1, the outputs of equations [2] and [3] were calculated to provide the range of annual loads to the MS4 from OFEE each year (L_i) and the associated range of loads reduced each year (LR_i) between 2005 and 2040 (Table 4-2). The total loads reduced during any given time period is calculated using equation [1] by summing the annual loads reduced (LR_i in Table 4-2) for all years within the time period of interest. For MRP 3.0, the time period of interest is assumed to be the five years of the permit term from 2022 to 2026. Therefore, the total loads reduced through the Electrical Utility Management Program during MRP 3.0 range from 0.056 kg/yr to 0.104 kg/yr (average 0.081 kg/yr).

All Permittees will receive a share of the total PCBs load reductions achieved as a result of program implementation based on the accepted countywide apportionment method (e.g., population).

Table 4-2: The calculated annual loads of PCBs to the MS4 from PCBs-containing OFEE (L_i) and the annual loads of PCBs reduced due to removal of PCBs-containing OFEE for the time period between 2005 and 2040. The values for L_i and LR_i were calculated using equations [2] and [3] and inputs provided in Table 4-2.

Year *i*	*x* = number of years since the start of the TMDL in 2005	L_i = Annual Load of PCBs (kg/yr) to the MS4 from OFEE (kg/yr)			LR_i = Annual Load of PCBs Reduced in Year *i* due to OFEE Removal (kg/yr)		
		Low F = 1.3%	Average F = 2.3%	High F = 4.8%	Low F = 1.3%	Average F = 2.3%	High F = 4.8%
2005	**0**	**1.1**	**1.1**	**1.1**	0.014	0.025	0.053
2006	**1**	1.086	1.075	1.047	0.014	0.025	0.050
2007	**2**	1.072	1.050	0.997	0.014	0.024	0.048
2008	**3**	1.058	1.026	0.949	0.014	0.024	0.046
2009	**4**	1.044	1.002	0.904	0.014	0.023	0.043
2010	**5**	1.030	0.979	0.860	0.013	0.023	0.041
2011	**6**	1.017	0.957	0.819	0.013	0.022	0.039
2012	**7**	1.004	0.935	0.780	0.013	0.021	0.037
2013	**8**	0.991	0.913	0.742	0.013	0.021	0.036
2014	**9**	0.978	0.892	0.707	0.013	0.021	0.034
2015	**10**	0.965	0.872	0.673	0.013	0.020	0.032
2016	**11**	0.953	0.852	0.640	0.012	0.020	0.031
2017	**12**	0.940	0.832	0.610	0.012	0.019	0.029
2018	**13**	0.928	0.813	0.580	0.012	0.019	0.028
2019	**14**	0.916	0.794	0.552	0.012	0.018	0.027
2020	**15**	0.904	0.776	0.526	0.012	0.018	0.025
2021	**16**	0.892	0.758	0.501	0.012	0.017	0.024
2022	**17**	0.881	0.741	0.477	0.011	0.017	0.023
2023	**18**	0.869	0.724	0.454	0.011	0.017	0.022
2024	**19**	0.858	0.707	0.432	0.011	0.016	0.021
2025	**20**	0.847	0.691	0.411	0.011	0.016	0.020
2026	**21**	0.836	0.675	0.392	0.011	0.016	0.019
2027	**22**	0.825	0.659	0.373	0.011	0.015	0.018
2028	**23**	0.814	0.644	0.355	0.011	0.015	0.017
2029	**24**	0.804	0.629	0.338	0.010	0.014	0.016
2030	**25**	0.793	0.615	0.322	0.010	0.014	0.015
2031	**26**	0.783	0.601	0.306	0.010	0.014	0.015
2032	**27**	0.773	0.587	0.291	0.010	0.013	0.014
2033	**28**	0.763	0.573	0.277	0.010	0.013	0.013
2034	**29**	0.753	0.560	0.264	0.010	0.013	0.013
2035	**30**	0.743	0.547	0.251	0.010	0.013	0.012
2036	**31**	0.733	0.535	0.239	0.010	0.012	0.011
2037	**32**	0.724	0.522	0.228	0.009	0.012	0.011

Year *i*	*x* = number of years since the start of the TMDL in 2005	L_i = Annual Load of PCBs (kg/yr) to the MS4 from OFEE (kg/yr)			LR_i = Annual Load of PCBs Reduced in Year *i* due to OFEE Removal (kg/yr)		
		Low F = 1.3%	Average F = 2.3%	High F = 4.8%	Low F = 1.3%	Average F = 2.3%	High F = 4.8%
2038	**33**	0.714	0.510	0.217	0.009	0.012	0.010
2039	**34**	0.705	0.499	0.207	0.009	0.011	0.010
2040	**35**	0.696	0.487	0.197	0.009	0.011	0.009

6. PROGRAM FOR MANAGING PCBS-CONTAINING MATERIALS AND WASTE DURING BUILDING DEMOLITION

6.1 Program Description

The MRP Permittees have developed and implemented a process, beginning in July 2019, for managing materials with PCBs concentrations of 50 ppm or greater in applicable structures at the time such structures undergo demolition. Applicable structures include commercial, public, institutional, and industrial buildings constructed or remodeled between the years 1950 and 1980 undergoing full-building demolition. Single-family residential and wood frame structures are exempt.

6.2 Loads Reduced Accounting Methodology

The load of PCBs reduced through implementation of the PCBs in Building Materials Management Program will be assessed using the following accounting method:

$$Load\ of\ PCBs\ Reduced = \left[\sum_{i=1}^{n}(N_i \bullet M_i \bullet SW_i)\right] \bullet E_f$$

Where:

N_i = Number of applicable buildings demolished each year (units/yr)

M_i = Average mass of PCBs per applicable building (mg/unit)

SW_i = Average fraction of PCBs that enters the MS4 due to demolition without controls (%)

E_f = Average fraction of PCBs prevented by controls from entering MS4 (%)

Reasonable values were used to assign the load reduction for this control measure in MRP 2.0. Permittees received a total of 2,000 g/yr (2 kg/yr) PCBs load reduction value in 2019 when protocols for managing PCBs-containing materials during demolition, as required in MRP 2.0 Provision C.12.f., were developed and implemented. Table 3-1 below lists the four terms and the assumed values used to derive the 2 kg/yr credit. These values may be updated based on data gathered in the future, as described below.

Table 3-1: Terms Used to Estimate the Loading of PCBs in Building Materials for MRP 2.0

Term	Estimated Value	Units
1. Number of applicable buildings[1] demolished per year	50	buildings/year
2. Average mass of PCBs per applicable building	5	kg
3. Average fraction of PCBs that enters MS4s due to demolition without controls[2]	0.01	dimensionless fraction
4. Average fraction of PCBs prevented by controls[2] from entering MS4	0.8	dimensionless fraction

[1]Applicable buildings: constructed from 1950 through 1980 with PCBs concentration in caulks/sealants greater than 50 ppm, excluding single family residential and wood frame buildings.

[2]The term "controls" refers to the proposed new demolition management program, not existing construction controls.

The 2 kg/yr PCBs load reduction stipulated during MRP 2.0 will be retained. During the MRP 3.0 permit term, Permittees may, with the necessary supporting data, request an increase in the credit received for the current program and/or expand the scope of the program to increase loads reduced. Any proposed revision of load reduction credit and/or program expansion would be submitted to the Regional Water Board for Executive Officer approval.

7. PROGRAM FOR MERCURY LOAD AVOIDANCE AND REDUCTION

7.1 Program Description

Mercury load avoidance and reduction includes a number of source control measures listed in the California Mercury Reduction Act adopted by the State of California in 2001. These source controls include material bans, reductions of the amount of mercury allowable for use in products, and mercury device recycling. The following source controls bans are included:

- Sale of cars that have light switches containing mercury;
- Sale or distribution of fever thermometers containing mercury without a prescription;
- Sale of mercury thermostats; and,
- Manufacturing, sale, or distribution of mercury-added novelty items.

In addition, fluorescent lamps manufacturers continue to reduce the amount of mercury in lamps sold in the U.S. Manufactures have significantly reduced the amount of mercury in fluorescent linear tube lamps and streetlamps. The use of mercury containing bulbs has also decreased through replacement of these bulbs with LED lamps.

Mercury Device Recycling Programs resulting in Mercury load reduction generally include three types of programs that promote and facilitate the collection and recycling of mercury–containing devices and products:

1. Permittee-managed household hazardous waste (HHW) drop-off facilities and curbside or door-to-door pickup;
2. Private business take-back and recycling programs (e.g., Home Depot); and,
3. Private waste management services for small and large businesses.

7.2 Loads Avoided/Reduced Accounting Methodology

The load avoidance/reduction methodology for this control measure is:

$$HgReductionL/S/T = BaseLoadLST - CurLoadLST$$

Where:

BaseLoadLST	=	Baseline load of mercury in urban stormwater in 2002 from lamps (L), switches (S), and thermostats (T)
CurLoadLST	=	Current load of mercury in urban stormwater in year of interest from lamps (L), switches (S), and thermostats (T)

And:

BaseLoadLST	=	BaseMassL/S/T • BaseNumL/S/T • T
CurLoadLST	=	CurMassL/S/T • CurNumL/S/T • T

Where:

$BaseMass_{LST}$	=	Average mass of total mercury in each lamp (L), switch (S), and thermostat (T) in 2002 (Assume: 93mg per kilogram of linear fluorescent lamp or Compact Fluorescent Lamp (CFL); 2.9g per switch; and 4g per thermostat).
$CurMass_{LST}$	=	Average mass of total mercury in each lamp (L), switch (S), and thermostat (T) recycled in year of interest (Assume: 35mg per kilogram of linear fluorescent lamp or CFL; 2.9g per switch; and 4g per thermostat).
$BaseNum_{LST}$	=	Number or weight of lamps (L), switches (S), and thermostats (T) improperly discarded into the environment in 2002.
$CurNum_{LST}$	=	Number or weight of lamps (L), switches (S), and thermostats (T) discarded into the environment improperly in year of interest.
T	=	% of total mercury in lamps (L), switches (S), and thermostats (T) that when improperly discarded are transported to the Bay via urban stormwater (Assume 4.8%).

And:

BaseNumLST	=	BaseSpentL/S/T - BaseRecycleL/S/T
CurNumLST	=	CurSpentL/S/T - CurRecycleL/S/T

Where:

BaseSpentLST	=	Number or weight of lamps (L), switches (S), and thermostats (T) that reached their end-of-life in 2002
BaseRcyLST	=	Number or weight of lamps (L), switches (S), and thermostats (T) recycled in 2002
CurSpentLST	=	Number or weight of lamps (L), switches (S), and thermostats (T) that reached their end-of-life in year of interest
CurRecycleLST	=	Number or weight of lamps (L), switches (S), and thermostats (T) recycled in year of interest

Table 9-1 below provides conversion factors and references for the assumed values used in these calculations.

Table 9-1: Mercury Recycling Conversion Factors and References

Item	Conversion and Citation
Fluorescent Lamps	The average mercury content for a four-foot linear fluorescent lamp is 8.3 milligrams (mg). This is equal to 2.075 mg (2.075 X 10 -6 kilograms (kg)) per linear foot. Source: NEMA 2005. Fluorescent and Other Mercury-Containing Lamps and the Environment: Mercury Use, Environmental Benefits, Disposal Requirements. National Electrical Manufacturers Association. March 2005. 14p.
Compact Fluorescent Lamps (CFLs)	The National Electrical Manufacturers Association (NEMA) announced that under the new voluntary commitment, effective October 1, 2010, participating manufacturers will cap the total mercury content in CFLs that are under 25 watts at 4 mg per unit, and CFLs that use 25 to 40 watts of electricity will be capped at 5 mg per unit. Each CFL recycled is assumed to have an average mass of 4.5 mg (4.5 X 10 -6 kg). New CFLs are also assumed to have 4.5 mg on average. Source: NEMA 2010. NEMA Lamp Companies Agree to Reduction in CFL Mercury Content Cap. Available at http://www.nema.org/media/pr/20101004a.cfm. Accessed April 11, 2012.
High Intensity Discharge (HID) Lamps	The average content of a HID bulb is .5 milligrams of mercury (0.5 x 10 -6 kg). Source NEMA Opposition to Ban on Mercury Containing Headlamps, 2004 http://www.nema.org/Policy/Environmental-Stewardship/Lamps/Documents/HID%20Headlamps%2010%2004.pdf
Thermostats	The amount of mercury in a thermostat is determined by the number of ampoules. There are generally one or two ampoules per thermostat (average is 1.4) and each ampoule contains an average of 2.8 grams (g) of mercury. Therefore, each thermostat recycled is assumed to contain approximately 4.0 g (0.004 kg) of mercury. Source: TRC 2008. Thermostat Recycling Corporation's Annual Report for the U.S. Prepared by the Thermostat Recycling Corporation. http://www.thermostat-recycle.org/files/u3/2008 TRC Annual Report.pdf. Each thermostat recycled is assumed to contain approximately 4.0 g (0.004 kg) of mercury. The average weight of one thermostat is 12 ounces. There are 1.3333 thermostats in a pound of thermostats (1 pounds/0.75 pounds = 1.33 thermostats. It is estimated that 0.005333 kg of mercury is recycled for every pound of thermostat recycled (1.333*0.004= 0.005333). Source: Average weight of thermostat obtained from retail websites - www.amazon.com.
Switches	The Recycling Corporation reports that one mercury switch contains 2.87 g (0.00287 kg) of mercury. Source: TRC 2010. Thermostat Recycling Corporation's Annual Report for California. Prepared by the Thermostat Recycling Corporation. Prepared for the State of California's Office of Pollution Prevention and Green Technology, Department of Toxic Substances Control. March 31, 2010.

8. PROGRAM UPDATES AND REFINEMENTS

The accounting methodology outlined in this report may be updated and refined to account for significant new information as it becomes available. If needed, the proposed updates will be submitted as an addendum to this report for Executive Office approval during the MRP 3.0 permit term.

9. REFERENCES

Alameda Countywide Clean Water Program (ACCWP), 2014. Integrated Monitoring Report Part C: PCB and Mercury Load Reduction. Prepared for ACCWP by Geosyntec Consultants. March 2014.

ACCWP, 2018. Quantitative Relationship Between Green Infrastructure Implementation and PCBs/Mercury Load Reductions. Prepared by Geosyntec Consultants for ACCWP. September 2018.

Bay Area Stormwater Management Agencies Association (BASMAA), 2014. Integrated Monitoring Report Part B: PCB and Mercury Loads Avoided and Reduced via Stormwater Control Measures. Prepared for BASMAA by Geosyntec Consultants and EOA, Inc. January 2014.

BASMAA, 2017a. Interim Accounting Methodology for TMDL Loads Reduced, Version 1.1. Prepared for BASMAA by Geosyntec Consultants and EOA, Inc. March 23, 2017.

BASMAA, 2017b. Bay Area Reasonable Assurance Analysis Guidance Document. Prepared for BASMAA by Geosyntec Consultants and Paradigm Environmental. June 30, 2017.

BASMAA, 2018. Evaluation of PCBs in Caulk and Sealants in Public Roadway and Storm Drain Infrastructure Project Report. Prepared for BASMAA by EOA, Inc.; SFEI; and Kinnetic Laboratories, Inc. August 16, 2018.

Contra Costa Clean Water Program (CCCWP), 2014. Integrated Monitoring Report Part C: Pollutants of Concern Implementation Plan. March 2014.

CCCWP, 2018. Quantitative Relationship Between Green Infrastructure Implementation and PCBs/Mercury Load Reductions. Prepared by Geosyntec Consultants for CCCWP. September 2018.

Fairfield-Suisun Urban Runoff Management Program (FSURMP) and the City of Vallejo and the Vallejo Sanitation and Flood Control District, 2014. Integrated Monitoring Report Part C: Pollutants of Concern Implementation Plan. March 2014.

FSURMP, 2018. Solano Permittee Technical Memorandum #1. GI/RAA Prioritization Approach: Deliverable for Task 1.4 and 2.1. Prepared by Fall Creek Engineering, Inc. for the Solano County Permittees. September 2018.

McKee, L., Mangarella, P., Williamson, B., Hayworth, J., and Austin, L., 2006. Review of methods used to reduce urban stormwater loads: Task 3.4. A Technical Report of the Regional Watershed Program: SFEI Contribution #429. San Francisco Estuary Institute, Oakland, CA.

Pacific Gas & Electric Company (PG&E), 2000. Correspondence from Robert Doss, PG&E's Environmental Support and Service Principal in response to San Francisco Regional Water Quality Control Board information request on historic and current PCB use. Pacific Gas and Electric Company, San Francisco, CA. September 1, 2000.

San Francisco Bay Regional Water Quality Control Board (SFBRWQCB), 2015. Municipal Regional Stormwater NPDES Permit, Order No. R2-2015-0049, NPDES Permit No. CAS612008. November 19, 2015.

SFBRWQCB, 2021. Municipal Regional Stormwater NPDES Permit, Tentative Order No. R2-2022-XXXX, NPDES Permit No. CAS612008. September 10, 2021.

San Mateo Countywide Water Pollution Prevention Program (SMCWPPP), 2014. Integrated Monitoring Report – Part C Pollutants of Concern Load Reduction Opportunities. March 2014.

SMCWPPP, 2018. Quantitative Relationship Between Green Infrastructure Implementation and PCBs/Mercury Load Reduction. Prepared by Paradigm Environmental for SMCWPPP. September 2018.

Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP), 2014. Watershed Monitoring and Assessment Program Integrated Monitoring Report – Part C Pollutants of Concern Load Reduction Opportunities. March 2014.

SCVURPPP, 2018. Quantitative Relationship Between Green Infrastructure Implementation and PCBs/Mercury Load Reduction. Prepared by Paradigm Environmental for SCVURPPP. September 2018.

Wu, J., Gilbreath, A.N., McKee, L.J., 2016. Regional Watershed Spreadsheet Model (RWSM): Year 5 Progress Report. A technical report prepared for the Regional Monitoring Program for Water Quality in San Francisco Bay (RMP), Sources, Pathways and Loadings Workgroup (SPLWG), Small Tributaries Loading Strategy (STLS). Contribution No. 788. San Francisco Estuary Institute, Richmond, California.

APPENDIX A

Land Use-Based Yield Analysis

A.1 METHODOLOGY

The methodology presented in this appendix was developed to assist the MRP Permittees in identifying which watershed characteristics correlate well with areas that have high, moderate, and low rates of pollutant of concern (POC) (i.e., mercury and PCBs) loading to receiving waters via stormwater runoff. The methodology was developed using the collective local understanding of the types of land areas, facilities, and activities that generate POCs, with a focus on PCBs. The ultimate goal of the analysis was to provide first order estimates of POC loading rates from high, moderate, and low likelihood source areas and to assist Permittees in identifying areas for implementing POC load reduction measures that would have the greatest load reduction benefit.

A.1.1 Source Area Mapping

Documented uses and sources of PCBs and mercury in the urban environment and the results of PCBs source identification and abatement studies described in the 2014 Integrated Monitoring Report (IMR) Part B (BASMAA, 2014) have been used to identify PCBs source areas. Findings demonstrate that PCBs (and to a lesser extent mercury) sources are generally associated with watershed areas where equipment containing POCs were transported or used and facilities that recycle POCs or POC-containing devices and equipment. These sources include current and historic metal, automotive, and hazardous waste recycling and transfer stations; electrical properties and power plants; and rail lines. These sources are typically located in areas that were industrialized between the late 1920's and the late 1970's, the timeframe when PCBs and mercury production were the greatest in the U.S.

To assist Permittees in identifying potential POC sources and source areas, a number of preliminary GIS data layers were developed using existing and historical information on land use and facility types that were located in the Bay Area during the early to mid-20th century. GIS data layers included a revised "Old Industrial" land use layer that attempted to depict industrial areas that were present in the year 1968; an "Old Urban" land use layer that depicts urban areas developed by 1974, other than those depicted as Old Industrial; points depicting current facilities that have the potential to have or have had PCBs on-site; and historical and current rail lines where PCBs may have been transported.

A.1.1.1. Old Industrial Land Areas

Three sets of data layers were acquired and served as the primary sources of information used to create the Old Industrial data layer: 1) the 2005 version of the Association of Bay Area Governments (ABAG) land use data layers for the five Bay Area counties, which depicts current industrial land use areas; 2) 1968 aerial photographs for the Bay Area at 30,000 scale acquired from the United States Geological Survey's (USGS) Earth Explorer website; and 3) the most currently available County Assessor parcel data layers for Bay Area counties. Through the development of the Old Industrial layer, two data layers were created. The first depicts industrial land areas in 1968 that are not currently characterized as industrial by ABAG. This data layer was created by panning through 1968 aerial photography and identifying industrial land areas outside of the areas characterized as industrial land use in roughly 2005 by ABAG. The purpose of this layer was to identify potential industrial facilities that were present in 1968, but possibly redeveloped or incorrectly identified within the ABAG land use data. The second data layer that was created depicts areas characterized by ABAG in 2005 as industrial land uses that were clearly not industrial in the 1968 aerial photographs. Most of these areas were developed into industrial land uses after 1968 and are most commonly agricultural in the aerial photographs. All parcels that were identified as at least partially industrial in 1968 were visually checked in the data layer to provide greater confidence in its accuracy. Minor edits were then made based on this quality assurance check. If there was uncertainty as to whether a parcel in the 1968 photographs was industrial, then the parcel was classified based on the ABAG land use data. As a final check, the 1968 aerial photographs were also compared to current aerial photographs and each parcel that had been redeveloped was attributed with the current land use, even if that land use remained industrial.

A.1.1.2. Old and New Urban Land Areas

Old Urban and New Urban land use data layers that depict areas urbanized prior to and after 1974, respectively, were developed using an urban extents data layer from 1974, the closest year to 1968 that the data were available. All areas that were within the urban extent in 1974 were defined as Old Urban; those areas that fell outside of this definition were classified as New Urban. Old Urban areas have been further divided into residential and parks areas versus commercial areas in the current land use classification schema.

A.1.1.3 Identification of Potential POC Associated Facilities

Point data were collected for a number of facility types that may be associated with either PCBs or mercury. These facility types include those associated with electrical generation, known mercury emitters, metal manufacturing, drum recycling, metal recycling, shipping, automotive recycling, general recycling, and those known to have or historically have had PCBs in use. This information was primarily gathered by the San Francisco Estuary Institute (SFEI) as part of the Urban Stormwater Best Management Practices (BMPs) Proposition 13 Grant project and contains data from a variety of sources, including the California Air Resources Board, EnviroStor, Superfund, Department of Toxic Substances Control, and the State Water Resource Control Board.

Certain facility types for which point data were developed were mapped in greater detail to develop polygons to allow area calculations to be performed. Of particular interest for PCBs were the several hundred electrical substations in the Bay Area. Areas for these facilities were delineated using current and 1968 aerial photographs to attribute whether each facility was built prior to or after 1968. Additionally, military, port, and railroad land use areas were developed using ABAG 2005 land use data and the latest assessor's parcel data. Military parcels were further edited to only include developed areas.

Land use and facility data layers created as part of this effort were then combined to create one contiguous data layer. This data layer was attributed with additional information such as city, county, and watershed.

A.2 Regional Watershed Spreadsheet Analysis

A.2.1 Background

The Regional Watershed Spreadsheet Model (RWSM) was developed as part of the Regional Monitoring Program's (RMP) Small Tributaries Loading Strategy as a regional-scale planning tool primarily for the purpose of estimating long-term average annual loads from the small tributaries surrounding San Francisco Bay, and secondarily to provide supporting information for prioritizing watersheds or areas within watersheds for management actions (Wu et al., 2016).

The RWSM is structured with three stand-alone empirical models: the hydrology model, the sediment model, and the pollutant model (Wu et al., 2016). The hydrology model uses runoff coefficients based on geospatially identified land use-soil-slope combinations along with rainfall based on PRISM average precipitation[1] to estimate annual runoff from a defined watershed area. The sediment model uses a function of geology, slope, and land-use to simulate suspended sediment transport in the landscape of a defined watershed while adjusting for watershed storage factors. The pollutant model is a spreadsheet model that combines land use-based pollutant concentrations (i.e., pollutant concentrations in water or pollutant concentrations on fine sediment particles as particle ratios[2] corresponding with specific land use types or source areas) with land use-based hydrology model output or sediment model output. Land use-based loading results are compiled to obtain pollutant loading across a defined watershed.

Starting in 2010, a multi-year effort was undertaken to systematically develop and calibrate the RWSM for San Francisco Bay watersheds using RMP data. Calibration was completed[3] and the model was released in 2018 (SFEI, 2018). For further detail about each component of the model, see the RWSM User Manual (SFEI, 2018).

A.2.2 RWSM Results

The estimated average PCBs and mercury yields from the RWSM Toolbox v1.0 Pollutant Model, "Pollutant Spreadsheet Model Calculations – Region" for the modeled land use yield categories are provided in Table A-1 below. The "Region" spreadsheet results were developed using RMP data from well-sampled watersheds to calibrate pollutant concentration coefficients and applying the resulting coefficients to the region to get average pollutant yield results (Gilbreath, 2019).

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[1] 800-m grid, from PRISM Climate Group, Oregon State University, http://prism.oregonstate.edu.

[2] Particle ratios = pollutant concentration in water (ng/L) / suspended sediment concentration (mg/L), equivalent to mg/kg.

[3] The calibration for PCBs is "reasonable" but there remains a lower confidence in the calibration for mercury (Wu et al., 2017).

Table A-1: RWSM Land Use-Based Yields for PCBs and Mercury

Land Use Category	Average PCBs Yield (mg/ac/yr)	Average Mercury Yield[1] (mg/ac/yr)
Old Industrial and Source Areas	259	53
Old Commercial and Old Transportation	49	57
Old Residential	2.8	57
New Urban	0.4	4
Agriculture/Open Space	0.4	81

mg/ac/yr – milligrams per acre per year
Note: RWSM Toolbox v1.0 Pollutant Model, Pollutant Spreadsheet Model Calculations - Region. Spreadsheet dated 6/9/2017.
1. The model calibration for PCBs is "reasonable" but there remains a lower confidence in the calibration for mercury (Wu et al., 2017).

Table A-2 below presents the RWSM Toolbox v1.0 Pollutant Model, "Pollutant Spreadsheet Model Calculations – Region" results for PCBs and mercury average concentrations in runoff for the five RWSM modeled land use categories (SFEI, 2018).

Table A-2: Regional Watershed Spreadsheet Model PCBs and Mercury Concentrations in Runoff

Land Use Category	Total PCBs (ng/L)	Total Mercury[1] (ng/L)
Old Industrial and Source Areas	204	40
Old Commercial and Old Transportation	40	63
Old Residential	4	63
New Urban	0.2	3
Agriculture/Open Space	0.2	80

1. The model calibration for PCBs is "reasonable" but there remains a lower confidence in the calibration for mercury (Wu et al., 2017).

A.3 Source Area/Property PCBs Yield

The derivation of the estimated PCBs source property yield is described below. The PCBs source property yield was derived as the product of a representative PCBs concentration in surface soils at known source properties and a representative soil/sediment yield for old industrial areas.

Table A-3 and Table A-4 present descriptive statistics for measured concentrations of PCBs from source properties located in Alameda, Contra Costa, Santa Clara, and San Mateo Counties. This dataset includes 670 PCBs surface soil samples from twelve source property locations as well as on-site source property data identified in the street and storm drain sediment dataset that has been compiled by BASMAA to-date (see Appendix B). All soil samples included in the analysis were collected from the 0 to 0.5-foot depth interval, with the exception those collected at one site, based on the assumption that the top six inches of soil would have the most potential to mobilize offsite via wind or rainfall erosion. Data collected from the 0 to 1.0-depth interval were included for the General Electric site in Oakland, as this represented the shallowest reported depth for that site. The range of PCBs concentration (mg/kg) in surface soils for individual Bay Area source properties are provided in Table A-3 and the summary statistics for all sites combined are provided in Table A-4.

Table A-3: Site specific PCBs concentration in surface soil collected on-site from source properties located in Alameda, Contra Costa, Santa Clara, and San Mateo Counties.

Site Location	Minimum (mg/kg)	Average (mg/kg)	Maximum (mg/kg)	Count	Reference
1411 Industrial Rd, San Carlos	1.66	236.31	418.00	5	EKI Environment and Water, 2018. Letter from EKI to Mark Johnson, RWQCB, October 8, 2018. Subject: PCB Storm Drain Sediment Sampling Results 1411 Industrial Road, San Carlos, CA (EKI B80090.00)
270 Industrial Road and 495 Bragato Rd, San Carlos (Delta Star Inc./Tiegel Manufacturing Co.)	3.40	28.36	122.00	14	GHD, 2016. Incremental Sampling Investigation Report. August 4.
335 Brokaw Road, Santa Clara	3.56	3.56	3.56	1	SCVURPPP POC Monitoring
1645 Old Bayshore Highway, San Jose	11.91	11.91	11.91	1	SCVURPPP POC Monitoring
1695 and 1775 Monterey Highway, San Jose	5.47	6.26	7.06	2	SCVURPPP POC Monitoring
1800 South Monterey Road, San Jose	1.79	2.70	3.61	2	SCVURPPP POC Monitoring
Union Pacific Railroad at Schallenberger Road, San Jose	2.80	2.80	2.80	1	CW4CB Final Report/database (http://basmaa.org/Clean-Watersheds-for-a-Clean-Bay-Project)
Union Pacific Railroad Leo Avenue, San Jose	0.02	12.86	127.00	45	GHD, 2017. Remedial Investigation Report. Union Pacific Railroad Property, Leo Avenue ROW, San Jose, CA. September.
ETT111, Oakland	3.70	3.70	3.70	1	Kleinfelder, 2006. Private Property Sediment Sampling Report: Ettie Street Watershed, Oakland, California. Kleinfelder West, Inc.
3430 Wood Street, Oakland (Granite Expo)	93.41	93.41	93.41	1	ibid
1797 12th St, Oakland (Cole Brothers Auto Wrecker)	1.67	1.67	1.67	1	ibid
3015 Adeline St, Oakland (California Electric)	6.08	6.08	6.08	1	ibid
1266 14th St, Oakland (Amtech Lighting)	5.70	5.70	5.70	1	ibid
3425 Ettie St, Oakland (Allied Painter)	1.75	1.75	1.75	1	ibid
2838 Hannah St, Oakland (Former Giampolini)	0.74	9.23	17.73	2	ibid
3428-3434 Helen Street, Oakland (ACM)	10.62	10.62	10.62	1	ibid

Site Location	Minimum (mg/kg)	Average (mg/kg)	Maximum (mg/kg)	Count	Reference
1639 18th St, Oakland (Martinez Bros Trucking)	1.95	1.95	1.95	1	ibid
2601-2812 Peralta St, Oakland (Custom Alloy Scrap Sales)	1.78	7.09	14.73	4	ibid
280 West MacArthur Blvd, Oakland (Kaiser Oakland)	0.01	1.67	27.20	101	Forensic Analytical Environmental Health Consultants, 2017. PCB Soil and Sediment Waste Characterization and Disposal Plan, Kaiser Permanente Medical Center Oakland Legacy Tower Demolition Project, 280 West MacArthur Boulevard, Oakland, CA. Revised April 21, 2017.
710 73rd Avenue, Oakland (Former Aero Plating)	0.01	101.42	790.00	8	Fugro Consultants, Inc. 2016. Limited Soil Sampling Investigation, 710 73rd Avenue, Oakland, CA. January.
700 73rd Avenue, Oakland (Union Pacific Railroad)	0.92	88.16	1,100	14	CDM Smith, 2014. Report of Findings for Data Gaps Investigation Phase B - On-site Investigations, Union Pacific Railroad Company Property, 700 73rd Avenue Oakland, CA. November 14.
5441 International Boulevard, Oakland (General Electric)	0.03	248.36	11,000	134	Geosyntec Consultants, 2009. Feasibility Study Report for the GE Site at 5441 International Boulevard, Oakland, CA. June.
4560 Horton Street, Emeryville (Former South Southern Pacific Railroad)	0.03	0.40	1.91	6	EKI, 2016. Corrective Action Work Plan – Shallow Soil Excavation, Former SPRR Parcel South of 53rd Street, Emeryville, CA. June 29.
One Cyclotron Rd, Berkeley (Lawrence Berkeley National Laboratory)	0.0019	3.23	135.0	227	Lawrence Berkeley National Laboratory, 2016. Quarterly and Semiannual Progress Reports, for the LBNL Hazardous Waste Facility Permit. Environmental Restoration Program. August 1993 through February 2016.
CC-SPL-600-P	1.29	1.29	1.29	1	Contra Costa County 2015 POC Sampling
San Diego St, Richmond (San Diego St)	0.03	0.12	1.20	14	Arcadis, 2016. San Diego Street Transformer Oil Release Cleanup and Closure Report, West End of San Diego Street Richmond, CA, February.
1014 Chesley Ave, Richmond (World Oil)	0.01	0.79	6.50	70	APEX, 2018. PCB Characterization Report, World Oil Corporation Property, 1014 Chesley Avenue, Richmond, California. July 13.
1215 Willow Pass Road, Pittsburg (Molino)	0.02	1.19	5.60	10	Ground Zero Analysis, 2016. Phase II Investigation at 1215 Willow Pass Road, Pittsburg, November 11.
Average for All Properties		**31.88**			

Table A-4: Summary of PCBs concentration in surface soil collected on-site from source properties located in Alameda, Contra Costa, Santa Clara, and San Mateo Counties.

Statistic	PCBs (mg/kg)
Maximum	11,000
90th Percentile	36.90
75th Percentile	4.80
Average	57.71
Median	0.57
25th Percentile	0.069
10th Percentile	0.0020
Minimum	0.0019
N	670

Based on the data reviewed, the Bay Area wide average of PCBs in surface soil from known source properties based on individual property averages is 31.9 mg/kg (Table A-3) and the average based on individual sample concentrations is 57.7 mg/kg (Table A-4). An average concentration is the appropriate metric to use for the yield estimate as it is representative of the total expected loading, which is affected by very high concentrations.

A sediment yield for Old Industrial land uses within the Santa Clara Basin watersheds was estimated based on a Loading Simulation Program – C++ (LPSC) watershed model developed for the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) as part of their reasonable assurance analysis (Paradigm Environmental, 2019 (attached)). The sediment yield estimated from the LPSC watershed model represents baseline hydrology and water quality, specifically sediment and solids. The median, LPSC-modeled sediment yield from Old Industrial land uses in the Santa Clara Basin is 39 grams/m^2/year or 157.8 kg/acre/year. Using the average PCBs concentration, estimated in two different approaches, of 31.9 mg/kg and 57.7 mg/kg from surface soils on Bay Area source properties presented above and the median Old Industrial sediment yield of 157.8 kg/acre, the estimated PCBs yield from source properties is 5,031 mg/acre/year and 9,108 mg/acre/year, respectively.

For mercury, the RWSM yield value for old industrial/source areas will be used for load reduction accounting.

A.4 LIMITATIONS AND UNCERTAINTY

Land use is used as a surrogate for actual PCBs and mercury sources, and although the types of potential sources have been identified, the actual locations and sizes of sources are difficult to determine at this level of analysis. While categorized the same for modeling and analysis purposes, similar land use in different locations may have very different sources and thus distinctly different PCBs and mercury concentrations in runoff.

It is difficult to quantitatively assess the implications of these limitations on the projected magnitude of loads, especially as analysis shifts from regional to more refined spatial scales. The projected loads should be considered first order approximation and reflective of the central tendency of the data for the Bay Area as a whole.

A.5 REFERENCES

Gilbreath, Alicia, 2019. Personal communication via email, 2/26/2019.

McKee, L.J., Gilbreath, A.N., Wu, J., Kunze, M.S., Hunt, J.A., 2014. Estimating Regional Pollutant Loads for San Francisco Bay Area Tributaries using the Regional Watershed Spreadsheet Model (RWSM): Year's 3 and 4 Progress Report. A technical report prepared for the Regional Monitoring Program for Water Quality in San Francisco Bay (RMP), Sources, Pathways and Loadings Workgroup (SPLWG), Small Tributaries Loading Strategy (STLS). Contribution No. 737. San Francisco Estuary Institute, Richmond, California.

San Francisco Estuary Institute (SFEI), 2018. Regional Watershed Spreadsheet Model (RWSM) Toolbox v1.0 User Manual and Pollutant Model. Available here: https://www.sfei.org/projects/regional-watershed-spreadsheet-model#sthash.kOKnKvF2.dpbs.

Wu, J., Gilbreath, A.N., McKee, L.J., 2017. Regional Watershed Spreadsheet Model (RWSM): Year 6 Progress Report. A technical report prepared for the Regional Monitoring Program for Water Quality in San Francisco Bay (RMP), Sources, Pathways and Loadings Workgroup (SPLWG), Small Tributaries Loading Strategy (STLS). Contribution No. 811. San Francisco Estuary Institute, Richmond, California.

Wu, J., Gilbreath, A.N., McKee, L.J., 2016. Regional Watershed Spreadsheet Model (RWSM): Year 5 Progress Report. A technical report prepared for the Regional Monitoring Program for Water Quality in San Francisco Bay (RMP), Sources, Pathways and Loadings Workgroup (SPLWG), Small Tributaries Loading Strategy (STLS). Contribution No. 788. San Francisco Estuary Institute, Richmond, California.

APPENDIX B

Urban Sediment Concentration Statistics

B.1 Descriptive Statistics

Tables B-1 and B-2, and Figures B-1 and B-2 presents descriptive statistics for the PCBs and mercury street and storm drain sediment dataset that has been compiled by BASMAA to-date. This dataset includes 1,535 PCBs samples and 1,350 mercury samples taken within the street right-of-way, storm drain conveyance system, and private properties from 1999 through 2019. Data are summarized by the predominant land use within the vicinity of where the sediment was collected.

Table B-1: PCBs concentrations in sediment (mg/kg) collected from streets, stormwater conveyance systems, and private properties located in Alameda, Contra Costa, Santa Clara, San Mateo, and Solano Counties between 1999 and 2019.

Statistic	Old Industrial	Old Urban (Not Residential/Parks)	Old Urban (Residential /Parks)	New Urban	Open Space	All Samples
Maximum	193	17	5.7	0.72	1.1	193
90th Percentile	1.1	0.18	0.30	0.27	0.19	0.77
75th Percentile	0.21	0.08	0.10	0.047	0.054	0.16
Mean	0.79	0.22	0.20	0.066	0.067	0.65
Geometric Mean	0.26	0.09	0.12	0.059	0.058	0.22
Median	0.05	0.03	0.023	0.016	0.009	0.041
25th Percentile	0.01	0.01	0.006	0.001	0.002	0.009
10th Percentile	ND	ND	ND	ND	ND	ND
Minimum	ND	ND	ND	ND	ND	ND
n	1,205	110	98	69	53	1,535

Table B-2: Mercury concentrations in sediment (mg/kg) collected from streets, stormwater conveyance systems, and private properties located in Alameda, Contra Costa, Santa Clara, San Mateo, and Solano Counties between 1999 and 2015.

Statistic	Old Industrial	Old Urban Not Res/Parks	Old Urban Res/Parks	New Urban	Open Space	All Samples
Maximum	21	1.7	4.5	13	4.3	21
90th Percentile	0.80	0.41	0.78	0.63	0.35	0.74
75th Percentile	0.30	0.22	0.40	0.27	0.20	0.29
Mean	0.43	0.20	0.43	0.46	0.29	0.41
Geometric Mean	0.29	0.13	0.19	0.27	0.11	0.28
Median	0.15	0.11	0.18	0.14	0.11	0.15
25th Percentile	0.088	0.071	0.082	0.100	0.046	0.086
10th Percentile	0.057	0.051	0.045	0.056	0.030	0.054
Minimum	ND	0.015	0.015	ND	0.020	ND
n	1,069	80	91	62	48	1,350

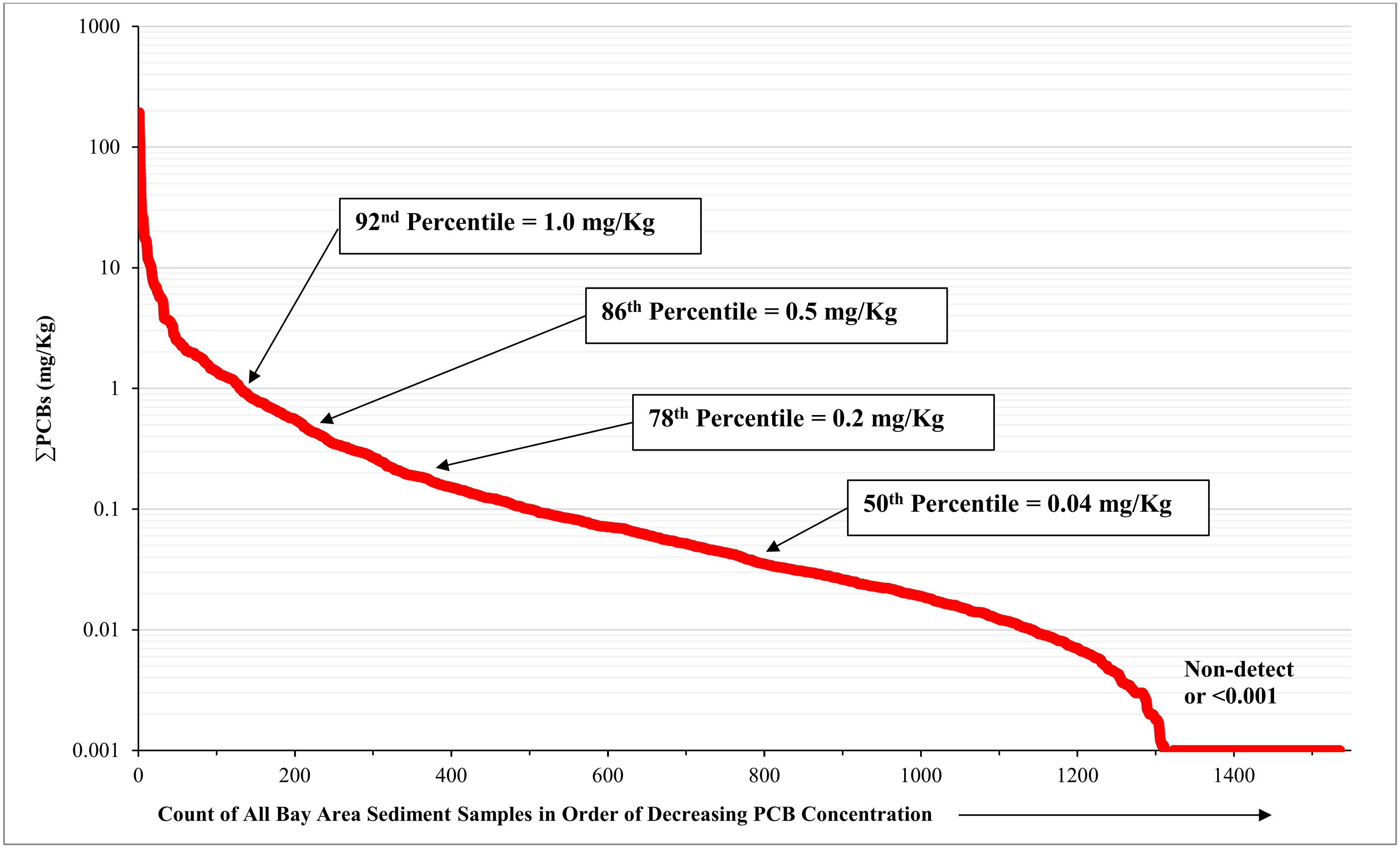

Figure B.1: Total PCB concentrations in sediment collected from streets, stormwater conveyance systems, and private properties located in Alameda, Contra Costa, Santa Clara, San Mateo, and Solano Counties between 1999 and 2019.

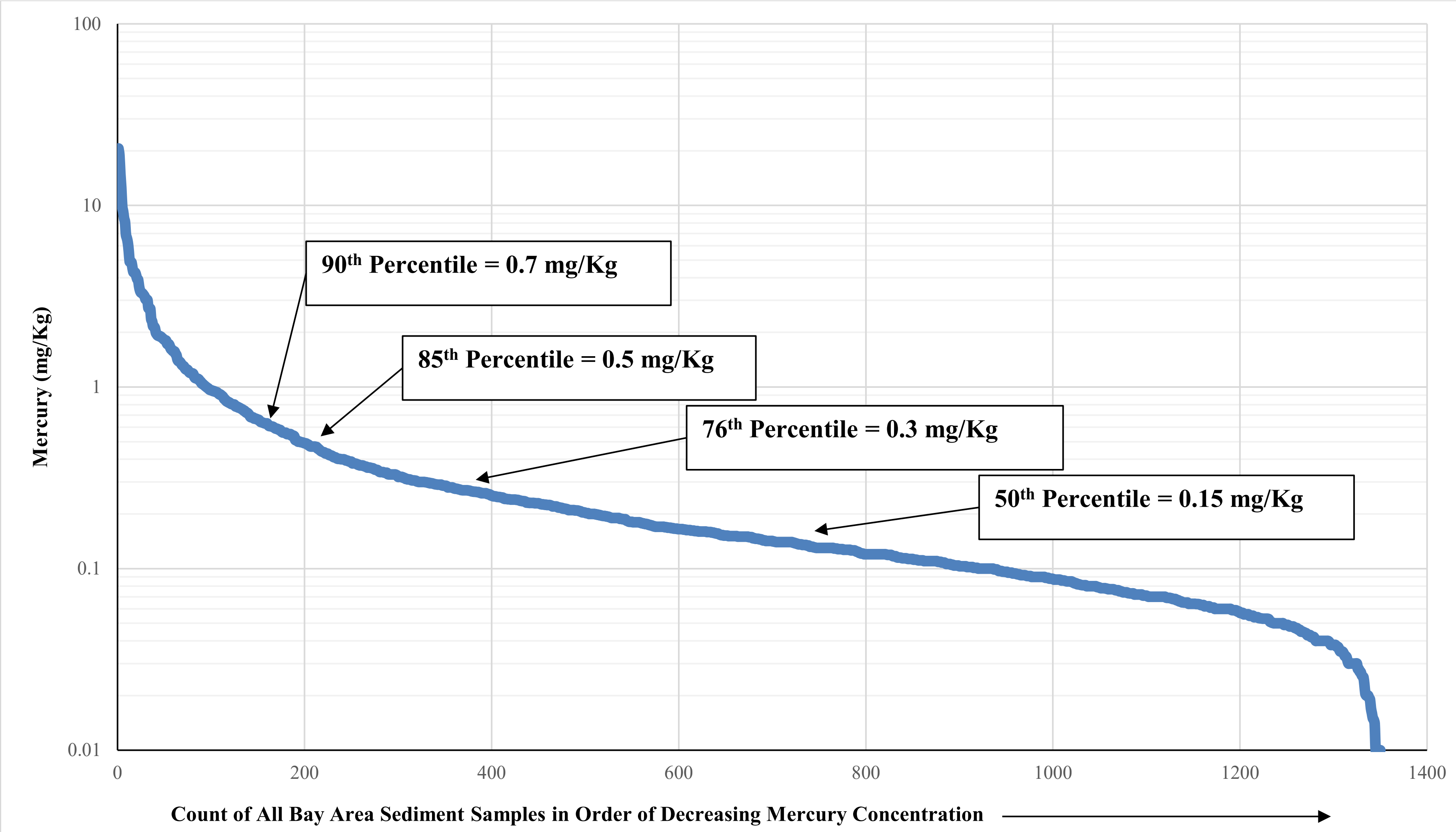

Figure B.2: Total mercury concentrations in sediment collected from streets, stormwater conveyance systems and private properties located in Alameda, Contra Costa, Santa Clara, San Mateo, and Solano Counties between 1999 and 2019.

APPENDIX C
Large Full Trash Capture Device Efficiency Factor Data Analysis

C.1 Purpose and Approach

The purpose of this appendix is to document findings of studies and analyses conducted to determine the effectiveness for removing total suspended solids (TSS), PCBs, and mercury by large (non-inlet-based) trash capture devices, including hydrodynamic separator (HDS) units, gross solids removal devices (GSRDs), and baffle boxes. Other types of non-inlet-based trash capture devices, such as trash netting devices and trash booms, are assumed to remove negligible amounts of sediment, PCBs, and mercury, so are not included in this appendix. Inlet-based devices, including inlet baskets and connector pipe screens, are discussed in Appendix G. For the purposes of load reduction accounting, the method assumes that HDS units, GSRDs, and baffle boxes reduce PCBs and mercury concentrations in direct proportion to TSS reduction.

C.2 HDS Units

Percent Removal of TSS. Percent removal of TSS in HDS units was calculated from the BASMAA Clean Watersheds for a Clean Bay (CW4CB) Task 5 Leo Avenue pilot project data (BASMAA 2017a). For this project, a prefabricated Contech HDS unit called the Continuous Deflective Separator (CDS) was retrofitted into the existing storm drain system in the Leo Avenue Watershed in San Jose.

Influent and effluent water quality was sampled at four events as summarized in Table C-1 below. The CDS unit removed an average of 30% of TSS coming into the unit.

Table C-1: Percent Removal of TSS at Leo Ave CDS Unit

Event	Date	Sample Location	TSS (mg/L)	% Removal
1	28-Feb-14	Inflow	110	17%
		Outflow	91	
2	29-Mar-14	Inflow	230	17%
		Outflow	190	
3	31-Oct-14	Inflow	62	88%
		Outflow	7.5	
4	02-Dec-14	Inflow	82	-3%
		Outflow	84.5	
Average				**30%**

The International Stormwater BMP Database (http://bmpdatabase.org/) was evaluated for potentially useful studies. Twenty studies of manufactured devices were identified as useful for analysis. These studies had a total of 334 paired inflow/outflow data points for TSS. Percent removal was calculated for each paired data point and then averaged for the BMP. The results for these studies along with descriptions of land use type and watershed size and imperviousness are presented in Table C-2 below. Average percent removal ranged from -85% (i.e., an increase in

TSS concentration in outflow compared to inflow) to 73% and averaged 19% across all studies (including the City of San Jose's Leo Avenue unit).

The dataset was also analyzed by removing BMPs that were treating just roads or highways, parking lots, or college campuses. In this scenario, ten studies remained that had mixed, other, or unknown land use type. The average percent removal of TSS from the BMPs evaluated in this group of studies was slightly higher at 22%.

Table C-2: Percent Removal of TSS for Studies in BMP Database

Site and BMP	Device Model	Land Use Type	Watershed % impervious	Watershed Area (ac)	Average TSS % Removal[1]
OP Soccer Complex: PMSU56_40_40	Contech CDS, Model PMSU56_40_10	Parking lots adjacent to soccer fields.	90	3.98	-85%
NW Birch Place CDS unit: Continuous Deflective Separation unit	CDS Unit	Low Density Residential: 47.4% Office Commercial: 42.2% Multi-Family Residential: 10.3%	--	45.0	-14%
Broadway Outfall: CDS Unit	CDS			132	-6%
University of New Hampshire F3: Continuous Deflective Separation	CDS	College Campus: 100%	100	0.32	-5%
Lake O Sediment Demo: CDS Unit	PSW56_53		--	--	-3%
I-210 / Orcas Ave: Orcas	CDS	Roads/Highway: 100%	100	1.11	-3%
USGS_WI_HSD_DD: Hydrodynamic Settling Device	Downstream Defender®, manufactured by Hydro International.		84	1.90	-1%
I-210 / Filmore Street: Filmore CDS	CDS	Roads/Highway: 100%	100	2.50	2%
University of New Hampshire F2: Environment 21 V2B1	Environment 21 V2B1	College Campus: 100%	100	0.32	5%
University of New Hampshire F1: Vortechnics	Vortechnics	College Campus: 100%	100	0.32	13%
USGS_WI_HSD: HSD	Hydrodynamic Settling Device, Contech	The HSD treats a 0.25-acre deck section of the westbound I–794 freeway	100	0.25	26%
Harrisburg Public Works Yard: PAYardTerreKleene	Terre Kleen	--	90	3.21	28%

Site and BMP	Device Model	Land Use Type	Watershed % impervious	Watershed Area (ac)	Average TSS % Removal[1]
SC_StructBMP3: BMP3	Vortechnics	BMP3 is located along the westbound lane of S.C. Highway 802	--	--	29%
Indian River Lagoon CDS Unit: CDS Unit	CDS	Open Space: 38% Light Industrial: 32% Office Commercial: 19%	11	61.5	30%
Leo Avenue: HDS Unit[2]	Contech CDS	--	--	--	30%
SC_StructBMP1&2: BMP2	CDS Technologies	BMP2 is located along the southbound lane of U.S. Highway 21	100	1.11	39%
University of New Hampshire E1: Aqua Swirl	Aqua Swirl	College Campus: 100%	100	0.99	40%
Timothy Edwards Middle School: Vortechs No 5000	Vortechs	--	80	1.95	45%
VC: VC	Vortcapture	Residential area with lots of organic matter/leaf litter loading	--	--	53%
Marine Village Watershed: VortechsTM Stormwater Treatment System	Vortechs	Office Commercial: 50% Medium Density Residential: 45% Unknown: 5%	95	9.34	72%
NJ Manasquan Bank: NJManasquanCDS	High Efficiency Continuous Deflective Separator (CDS), Model 20_25	--	79	0.89	73%

Notes: -- indicates information was not provided.

1. Based on analysis of paired inflow/outflow results.
2. Leo Ave CW4CB study. Not a BMPDB Study.

The manufacturer’s removal efficiency claims and the tested removal efficiencies of six of the BMPs evaluated in the studies were summarized as reported in the Massachusetts Stormwater Technology Evaluation Project (MASTEP) clearinghouse database (Table C-3).

Table C-3: Percent Removal of TSS for Six Manufactured Devices from MASTEP

Product (BMP)	Manufacturer	Manufacturer's Removal Efficiency claim	Tested Removal Efficiency
Aqua-Swirl	Aqua Shield	85%	84-87%
CDS	Contech	70%	65-95%
Vortechs	Contech	35-85%	35-64%
Downstream Defender	Hydro International	90%	70%
V2B1	Environment 21	80%	65%
Terre Kleen	Terre Hill	78%	17-50%
Average[1]			56%

Notes: 1. Average based on low end of reported efficiency range.

Based on the above findings, 20% is a conservative estimate of the average percent removal of TSS by HDS units.

Percent Removal of PCBs and Mercury. To further evaluate the pollutant removal performance of HDS units, BASMAA (2019) conducted a combined monitoring and modeling study in 2017 and 2018 based on the removal of solids captured within HDS unit sumps. The Project collected samples of the solids captured and removed from eight different HDS unit sumps during cleanouts. The solid samples were analyzed for PCBs and mercury concentrations. Maintenance records and construction plans for these HDS units were reviewed to develop estimates of the average volume of solids removed per cleanout and the typical number of cleanouts per year. This information was combined with the measured pollutant concentrations to calculate the annual mass of PCBs and mercury captured in the sumps and removed during cleanouts. Next, the annual pollutant loads discharged from each HDS unit catchment were estimated using two different load calculation methods. Method #1 used the land use-based pollutant yields described in the BASMAA Interim Accounting Methodology (BASMAA 2017b) to estimate catchment loads. Method #2 used the Regional Watershed Spreadsheet Model (RWSM, Wu et al. 2017) to estimate runoff volumes and stormwater concentrations and calculate catchment-specific loads. Finally, HDS unit performance was evaluated for both catchment load estimates by calculating the average annual percent removal of PCBs and mercury due to the annual mass removal of solids from the HDS unit sumps. Results are presented in Table C-4.

For catchment loads calculated using Method #1 (land use-based yields), the median percent PCBs removal across all eight units ranged from 5% to 10%, while the mean ranged from 17% to 28%. For catchment loads calculated using Method #2 (RWSM runoff volume x concentration), the median percent PCBs removal ranged from 15% to 32%, while the mean ranged from 23% to 36%. Variability in removal rates was high between individual units, ranging from almost no removal to 100% removal of the estimated loads. For mercury, across all eight units, the median percent removal for catchment loads calculated using Method #1 (land use-based yields) ranged from 3% to 4%, while the mean ranged from 5% to 8%. For all units under Method #1, the removal rates were lower for mercury than for PCBs. For catchment loads calculated using

Method #2 (RWSM runoff volume x concentration) the median removal ranged from 13% to 19%, while the mean ranged from 28% to 35%. Similar to PCBs, removal rates for mercury in individual HDS units were highly variable (Table C-4).

Table C-4. HDS Unit Performance - Annual Percent Removal Calculated for Two Catchment Load Estimates.

HDS Unit ID	PCBs Removal				Mercury Removal			
	Method #1		Method #2		Method #1		Method #2	
	Low	High	Low	High	Low	High	Low	High
1	80%	100%	100%	100%	26%	40%	100%	100%
2	8%	18%	10%	22%	4%	6%	65%	98%
3	4%	9%	21%	45%	2%	3%	8%	12%
4	38%	83%	27%	59%	5%	7%	17%	26%
5	0.06%	0.13%	0.21%	0.46%	0.1%	0.2%	1.1%	1.6%
6	5%	11%	20%	43%	0.01%	0.02%	0.1%	0.2%
7	0.6%	1.4%	0.5%	1.1%	0.06%	0.09%	2%	3%
8	1.4%	3.1%	7%	16%	3%	4%	27%	41%
Median	5%	10%	15%	32%	3%	4%	13%	19%
Mean	17%	28%	23%	36%	5%	8%	28%	35%

The BASMAA study results were highly variable and limited by the small sample size. However, pollutant load reductions achieved by HDS units, on average, approach or even exceed 20%, the value identified as a conservative estimate of TSS removal by HDS units in the analysis presented previously. These results support the continued use of a 20% efficiency factor for calculating the annual average PCBs and mercury loads reduced by HDS units.

I.3 Gross Solids Removal Devices

Caltrans conducted the Gross Solids Removal Devices (GSRDs) Pilot Program to develop and evaluate the performance of non-proprietary, full trash capture devices that could be retrofitted into existing highway drainage systems or incorporated into new highway projects (Sobelman et al.). The GSRD Pilot Program consisted of multiple phases with each phase representing one pilot study. The pilot studies consisted of one or more devices that were developed from concept through design and installation, with two years of pilot testing of overall performance. Five phases were constructed and monitored covering eleven designs. Four general types of GSRDs were developed and studied: linear, inclined screen, baffle box, and v-screen. Of the many configurations tested, the most promising devices, based on considerations of particle capture, clogging, passing design flow, drainage, stage capacity and maintenance requirements, were the Linear Radial (louvered modular well casing), the Inclined Screen (parabolic wedgewire screen) and the Inclined Screen (sloped flat wedge-wire screen). The linear radial and inclined screen devices have been certified by the Los Angeles Regional Water Quality Control Board as being full capture devices. Standard designs were developed for these screen systems that provided the best solids removal performance in the pilot tests.

The results of the first phase of the pilot program, which tested the linear radial and inclined screen devices, are summarized in Table C-5 below.

Table C-5. GSRD Unit Performance Observed by Caltrans (2003)

Device Type	Gross Solids Capture Efficiency by Wet Weight (%)	
	2000 – 2001	2001 – 2002
Linear Radial 1 (I-10)	100[1]	100
Linear Radial 2 (I-210)	97	87
Linear Radial 2 (I-5)	94	100
Inclined Screen 1 (SR-170)	100	100
Inclined Screen 2 (I-210)	83[2]	100
Inclined Screen 2 (US-101)	86[2]	73[2]
Average	**93%**	**93%**

Notes:

1 Material collected in the bypass bag was presumed to be windblown.

2 GSRD overflowed. Gross solids escaped the overflow structure and were unaccounted for. As a result, the calculated capture efficiencies are overstated.

Source: Caltrans, 2003.

Based on the above findings and assuming that the mass fraction of material associated with PCBs and mercury yields (i.e., sediment <63 µm) is approximately 15% on average of the captured debris (McKee et al., 2006), then the percent removal of PCBs and mercury by GSRDs is approximately 14% (93% gross solids removal x 15% of captured debris that is associated with PCBs and mercury).

C.4 Baffle Boxes

Baffle boxes are subsurface rectangular vaults that are placed inline in the stormwater system to reduce pollutant loadings by capturing sediments, gross solids, and associated pollutants. Treatment mechanisms typically include filtration, hydrodynamic separation, and adsorption. Several different types of baffle boxes are available commercially and have footprints that vary in size from approximately 10 square feet to over 200 square feet. These subsurface vaults are commonly subdivided into a series of chambers by vertical baffles that interrupt the stormwater flow and promote capture of suspended particles by sedimentation.

The treatment effectiveness of the Nutrient Separating Baffle Box ® (NSBB) by Suntree Technologies has been recently evaluated by the manufacturer to assess the suspended sediment removal efficiency under controlled conditions (Suntree Technologies, 2018). The NSBB contains an additional basket screen that is located above the top of the chamber baffles. The screen captures floating and suspended solids and holds them out of the water column during nonflow periods (Suntree Technologies, 2018). The performance evaluation was conducted on the NSBB model 3-6-72, which has an effective sedimentation area (i.e., footprint) of 18 square feet (6 feet by 3 feet). Additional details of this and other models can be found on the Suntree Technologies, Inc. website. Influent suspended sediment concentrations were measured at 200 mg/L with a median particle size of 100 µm; influent flow rates ranged from 0.35 to 1.75 cfs. Resulting annualized TSS removal efficiency ranged from approximately 51 to 68 percent, with a weighted annualized TSS removal efficiency of 62.9%. The annualized TSS removal efficiency for different flow rates is shown in Table C-6 below.

Table C-6: Nutrient Separating Baffle Box (Model 3-6-72) TSS Removal Efficiency

Mean Flow Rate Tested (cfs)	Measured Removal Efficiency	Annual Weighting Factor	Weighted Removal Efficiency
0.35	67.9%	0.25	16.98%
0.70	65.8%	0.3	19.74%
1.05	63.1%	0.2	12.62%
1.40	56.4%	0.15	8.46%
1.75	50.6%	0.1	5.06%
Weighted Annualized TSS Removal Efficiency			**62.9%**

Source: Suntree Technologies, Inc., 2018

A similar baffle box, the Debris Separating Baffle Box, is sold by Bio Clean. It is assumed that the unit processes in the two proprietary baffle box devices are similar, thus the expected removal efficiencies would be the same.

Based on the above study and assuming that the mass fraction of material associated with PCBs and mercury yields (i.e., sediment <63 µm) is approximately 63% of the captured sediment, then the percent removal of PCBs and mercury by baffle boxes is approximately 40% (63% TSS removal with a median particle size of 100 µm x 63% of material that is associated with PCBs and mercury). Given the limited data available on the effectiveness of baffle boxes in reducing PCBs and mercury, however, and the similarity of the baffle box to the mechanistic removal processes used in HDS systems, a conservative estimate is being used for PCB and mercury reduction for baffle boxes. The pollutant removal efficiency that will be used for baffle boxes is 20%, the same as HDS systems.

C.5 References

Bay Area Stormwater Management Agencies Association (BASMAA), 2017a. Clean Watersheds for a Clean Bay Project Report, Final Report May 2017. Bay Area Stormwater Management Agencies Association. Accessed at: http://basmaa.org/Clean-Watersheds-for-a-Clean-Bay-Project.

BASMAA, 2017b. Interim Accounting Methodology for TMDL Loads Reduced, Version 1.1. Prepared for BASMAA by Geosyntec Consultants and EOA, Inc. March 23, 2017.

BASMAA, 2019. Pollutants of Concern Monitoring for Management Action Effectiveness. Evaluation of Mercury and PCBs Removal Effectiveness of Full Trash Capture Hydrodynamic Separator Units. Final Project Report. February 20, 2019. Prepared for BASMAA by EOA, Inc., Office of Water Programs Sacramento State, San Francisco Estuary Institute, and Kinnetic Laboratories Inc. February 20, 2019.

Caltrans, 2003. Phase I Gross Solids Removal Devices Pilot Study: 2000 – 2002. Final Report October 2003. CTSW-RT03-072.31.22.

McKee, L., P. Mangarella, B. Williamson, J. Hayworth, and L. Austin (2006). Review of methods used to reduce urban stormwater loads: Task 3.4. A Technical Report of the Regional Watershed Program: Oakland, CA, San Francisco Estuary Institute SFEI Contribution #429: 150 pp.

Sobelman, Timothy, David Alderete, James Sullivan, and Foster McMasters. Evolution of Trash Management for Caltrans Freeways. Accessed at: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.631.6409&rep=rep1&type=pdf.

Suntree Technologies, Inc., 2018. Application for Trash Treatment Control Devices, Suntree Technologies, Inc. ® Nutrient Separating Baffle Box ® (NSBB™), Submitted to the California State Water Resources Control Board, September 17, 2018.

Wu, J; Gilbreath, A.; McKee, L. J. 2017. Regional Watershed Spreadsheet Model (RWSM): Year 6 Progress Report. SFEI Contribution No. 811. San Francisco Estuary Institute: Richmond, CA.

APPENDIX D
Enhanced Inlet Cleaning Efficiency Factor Data Analysis for Storm Drain Inlets with and without Inlet-based Full Trash Capture Devices

D.1 PURPOSE AND APPROACH

The purpose of this appendix is to document findings of analysis conducted to determine the enhanced efficiency factors (EE_f) for sediment removal associated with enhanced storm drain inlet maintenance, including increasing the frequency of storm drain inlet cleaning, and the use of small (inlet-based) full trash-capture (FTC) devices, that are expected to capture larger amounts of trash, sediment and vegetation. First, the pollutant removal efficiency was calculated for the baseline control measure, which was assumed to be annual cleanout of storm drain inlets without FTC devices. The efficiency factors were then developed for the following enhancements: (1) increased frequency of cleanouts at inlets without FTC devices; and (2) twice yearly cleanouts at inlets with FTC devices.

Based on a review of available literature, there are limited data available on the reductions of pollutants (including sediment) associated with different storm drain inlet maintenance frequencies. No studies were found that assessed the reduction of either PCBs or mercury due to enhanced inlet cleaning frequencies. Two studies in particular, Woodward Clyde (1994) and Caltrans (2003), however evaluated the increase in the removal of material (i.e., sediment, vegetation, and trash) from inlets under different cleaning frequencies. Results from both studies indicated that the annual volume of material removed from inlets increased with cleaning frequency.

The Caltrans (2003) *Drain Inlet Cleaning Efficacy Study* was designed to measure the potential increases in material volume/mass and water quality benefits due to increased inlet cleaning frequencies on freeways. The study was conducted from 1996 through 2000. The volume and mass of material removed under annual, biannual, and three times per year cleaning frequencies at 55 to 90 inlets, depending on the year, were measured.

The Woodward Clyde (1994) *Storm Inlet Pilot Study* was conducted in Alameda County in 1993. This study was also designed to measure the potential increases in material volume and mass due to increased inlet cleaning frequencies. A total of 15 inlets draining residential, industrial, or commercial land uses were monitored. The volume and mass of material removed under annual, biannual, quarterly, and monthly cleaning frequencies were measured.

None of the inlets in the two studies identified above were equipped with FTC devices. To evaluate pollutant reductions associated with cleanouts of storm drain inlets equipped with small FTC devices, a recent study (SCVURPPP, 2016) documented cleanout volumes of materials removed from inlets equipped with FTC devices. The SCVURPPP (2016) *Storm Drain Trash Monitoring and Characterization* study focused on litter/trash, but also removed and measured other debris (defined as sediment and vegetation) from 119 inlets equipped with small FTC devices. These devices typically require cleaning frequencies of at least twice per year. Each of the 119 inlets was initially cleaned at the start of the project. The volume of trash and debris that accumulated within the inlets was removed and measured during two subsequent monitoring events. The accumulation period between each monitoring event ranged from four to five months. The data were used to estimate the annual average volumes of trash and debris captured in each inlet. The annual volume of debris removed was converted to a mass using the average density of debris removed from inlets during the Woodward Clyde (1994) study, which was 38 pounds per cubic foot.

The percent increase of annual mass of debris removed from storm drain inlets during cleanouts, as measured in each of the three studies described above, is presented in Figure D-1. Caltrans removals for inlet cleaning without FTC devices appear to be much greater than removal efficiencies measured during the Woodward Clyde study, and therefore may not be realistic for the purposes of developing conservative efficiency factors for load reduction accounting. The Woodward Clyde study results were used to represent the enhanced efficiency due to increased cleanout frequency of storm drain inlets without FTC devices. The results of the SCVURPPP (2016) study indicate that the use of inlet-based FTC devices, combined with an increased cleaning frequency of twice annually, appears to substantially increase the annual mass of debris that is captured and removed from these storm drain inlets during cleanouts.

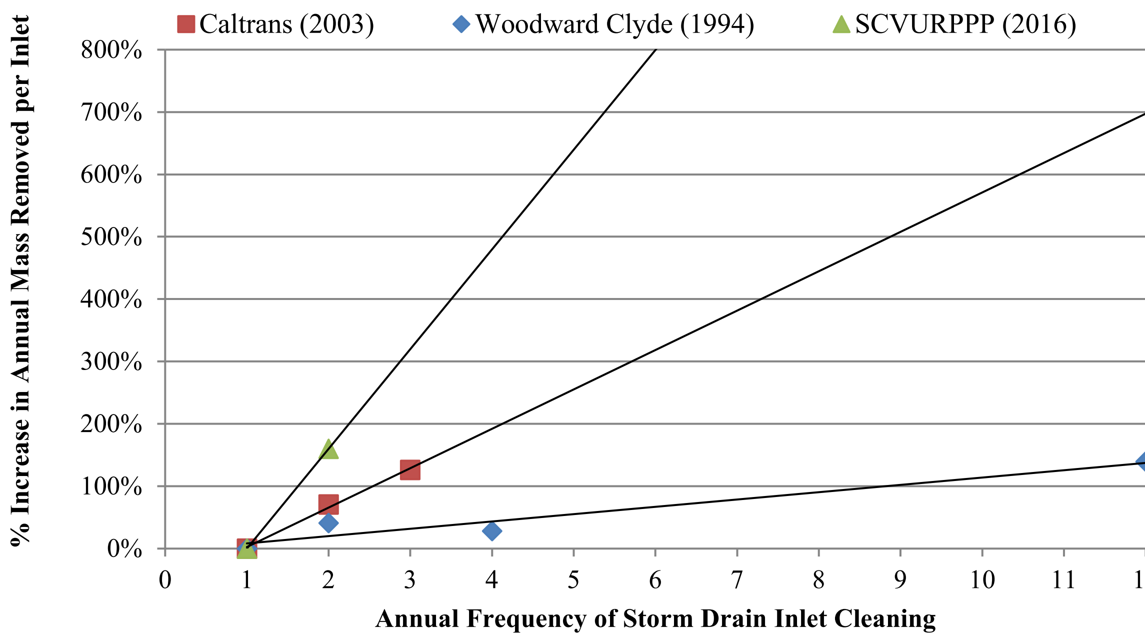

Figure D.1: Reported results of increases in annual mass of debris (e.g., sediment and vegetation) removed as a result of increased cleaning frequency for storm drain inlet with and without small full trash-capture (FTC) devices.

Based on the above findings, Table D-1 presents a conservative estimate of the enhanced efficiency factors for more frequent cleaning of storm drain inlets without FTC devices, and the enhanced efficiency factors for cleaning storm drain inlets equipped with inlet-based FTC devices at least twice per year. For the purposes of load reduction accounting, the method assumes the following:

- Based on an analysis of 36 Alameda County and San Mateo Permittee storm drain inlet cleaning datasets from 1996 through 2009, on average, municipalities clean their inlets once per year (annually);

- Based on the same dataset, an average of 100 kg of material (sediment, vegetation, and litter) is removed from each inlet annually (see descriptive statistics below);

Statistic	Mass (Kg) of Material Removed Annually per Inlet
Maximum	4,049
90th Percentile	476
75th Percentile	284
Mean	268
Geometric Mean	100
Median	91
25th Percentile	41
10th Percentile	21
Minimum	5
# of Municipalities in Dataset	36

- Each inlet (on average) receives drainage from a catchment of 1 acre (BASMAA, 2014), equating to a unit material removal rate of 100 kg per acre per year;
- The mass fraction of material associated with PCBs and mercury yields (i.e., sediment <63um) is approximately 15% on average (McKee et al., 2006);
- The annual suspended sediment load to each inlet is roughly 134 kg per year on average based on the modeled value for Old Urban land use (Paradigm Environmental, 2020, see attachment to Appendix A); and
- Based on the assumptions above, roughly 15 kg of sediment associated with PCBs and mercury is removed from each inlet cleaned on an annual frequency, equating to about a 11% reduction of PCBs and mercury via annual cleaning (i.e., 15 kg / 134 kg). This is the control measure effectiveness of annual cleaning of storm drain inlet without FTC devices.

Assuming the baseline control measure effectiveness for annual cleaning of 11%, data from the studies cited above were used to calculate the enhanced efficiency factors for storm drain inlet cleaning at increasing frequencies for inlets without FTC devices, and twice-yearly cleaning of inlets that have been equipped with small FTC devices, as shown in Table D-1.

Table D-1: Enhanced efficiency factors (EE_f) for increased storm drain inlet cleaning frequencies for storm drain inlets both with and without small full trash-capture (FTC) devices.

		Enhanced Cleaning Frequency for Inlets without FTC devices				Enhanced Cleaning Frequency for Inlets with FTC Devices
		Annually	Biannually	Quarterly	Monthly	Biannually
Original Cleaning Frequency	No Cleaning or New Inlet	0.11	0.16	0.16	0.27	0.29
	Annually		0.05	0.05	0.16	0.18

D.2 References

BASMAA (2014). San Francisco Bay Area Stormwater Trash Generation Rates - Final Technical Report. Bay Area Stormwater Management Agencies Association. Prepared by EOA, Inc. Oakland. June.

Caltrans (2003). Drain Inlet Cleaning Efficacy Study. California Department of Transportation. CTSW-RT-03-057.36.1. June.

McKee, L., P. Mangarella, B. Williamson, J. Hayworth, and L. Austin (2006). Review of methods used to reduce urban stormwater loads: Task 3.4. A Technical Report of the Regional Watershed Program: Oakland, CA, San Francisco Estuary Institute SFEI Contribution #429: 150 pp.

Paradigm Environmental (2020). Technical Memorandum: Modeled Yield Estimates from SCVURPPP (all ABAG HRUs). January 7, 2020.

SCVURPPP (2016). Storm Drain Trash Monitoring and Characterization Project. Santa Clara Valley Urban Runoff Pollution Prevention Program. Prepared by EOA, Inc. August.

Woodward-Clyde. 1994. Storm Inlet Pilot Study. Prepared for the Alameda County Urban Runoff Clean Water Program.

APPENDIX E
Enhanced Street Sweeping Efficiency Factors

E.1 DESCRIPTION OF THE ANALYSIS

The Clean Watersheds for Clean Bay (CW4CB)[4] Task 4 pilot projects evaluated enhancements of municipal operation and maintenance activities that remove sediments and associated pollutants, including PCBs and mercury. This objective coincided with Municipal Regional Stormwater NPDES Permit (MRP, Order R2-2009-0074) Provision C.12.d, which required MRP Permittees to evaluate at the pilot scale in five drainages, ways to enhance existing sediment removal and management practices such as municipal street sweeping, curb clearing parking restrictions, inlet cleaning, catch basin cleaning, stream and stormwater conveyance system maintenance, and pump station cleaning via increased effort and/or retrofits. MRP Provision C.12.d also required Permittees to evaluate existing information on high-efficiency street sweepers, with the goal of evaluating the cost-effectiveness of high-efficiency street sweeping relative to reducing pollutant loads.

Appendix B-1 of the CW4CB Final Report summarizes the results of the Task 4 enhanced street sweeping pilot project that occurred in four pilot study areas (two sites in Richmond and one each in San Jose and Sunnyvale). This study entailed collecting monitoring data in each pilot study area representative of the baseline sweeping condition. The monitoring data were then used to calibrate the Windows Source Loading and Management Model (WinSLAMM) to evaluate sediment, PCBs, and mercury in the pilot study areas. Once WinSLAMM calibrated using the pilot study data, it was used to model street sweeping performance in the pilot study areas during the baseline condition for sediment, PCBs, and mercury. WINSLAMM was also used to model the effectiveness of various street sweeping scenarios for the pilot study areas for removing sediment, PCBs, and mercury. The modeled scenarios included (1) different sweeper types, (2) sweeping frequencies, and (3) street roughness values. The modeled scenarios assumed parking controls were in effect.

The results of the scenario analysis are presented in Tables E-1 and E-2 below for PCBs and mercury, respectively.

[4] For more information, see: http://basmaa.org/Clean-Watersheds-for-a-Clean-Bay-Project.

Table E-1: Change in PCBs Mass Removal Efficiency (%) from Initial Street Sweeping Scenario to Final Scenario

				Final Scenario							
			Sweeper Type	Vacuum							
			Street Roughness	Rough	Intermediate	Rough	Intermediate	Rough	Intermediate	Intermediate	Rough
Initial Scenario	**Sweeper Type**	**Street Roughness**	**Frequency**	Once per 4 weeks	Once per 4 weeks	Once per 2 weeks	Once per 2 weeks	Once per week	Once per week	Twice per week	Twice per week
	None	None	None	9.9%	14%	15%	18%	19%	21%	21%	22%
	Vacuum	Intermediate	Once per week	-11%	-7%	-6%	-3%	-2%	0%	0%	1%
		Intermediate	Once per 2 weeks	-8%	-4%	-3%	0%	1%	3%	3%	3%
		Intermediate	Once per 4 weeks	-4%	0%	1%	4%	5%	7%	7%	8%
		Intermediate	Twice per week	-11%	-7%	-6%	-3%	-2%	0%	0%	1%
		Rough	Once per week	-9%	-5%	-4%	-1%	0%	2%	2%	2%
		Rough	Once per 2 weeks	-5%	-1%	0%	3%	4%	6%	6%	6%
		Rough	Once per 4 weeks	0%	4%	5%	8%	9%	11%	11%	12%
		Rough	Twice per week	-12%	-8%	-6%	-3%	-2%	-1%	-1%	0%

Notes:

1. Change in efficiency resulting from change in sweeping scenario shown in red (reduction in efficiency) and blue (increase in efficiency).

Table E-2: Change in Mercury Mass Removal Efficiency (%) from Initial Street Sweeping Scenario to Final Scenario

				Final Scenario							
			Sweeper Type	Vacuum							
			Street Roughness	Rough	Intermediate	Rough	Intermediate	Rough	Intermediate	Intermediate	Rough
Initial Scenario	**Sweeper Type**	**Street Roughness**	**Frequency**	Once per 4 weeks	Once per 4 weeks	Once per 2 weeks	Once per 2 weeks	Once per week	Once per week	Twice per week	Twice per week
	None	None	None	9.1%	10%	10%	10%	10%	11%	11%	11%
	Vacuum	Intermediate	Once per week	-1%	0%	0%	0%	1%	2%	2%	2%
		Intermediate	Once per 2 weeks	0%	0%	0%	0%	1%	2%	2%	2%
		Intermediate	Once per 4 weeks	0%	0%	1%	1%	1%	2%	2%	2%
		Intermediate	Twice per week	-1%	0%	0%	0%	1%	2%	2%	2%
		Rough	Once per week	-2%	-2%	-2%	-2%	-1%	0%	0%	0%
		Rough	Once per 2 weeks	-2%	-2%	-2%	-2%	-1%	0%	0%	0%
		Rough	Once per 4 weeks	-1%	-1%	-1%	-1%	0%	1%	1%	1%
		Rough	Twice per week	-2%	-2%	-2%	-2%	-1%	0%	0%	0%

Notes:

Change in efficiency resulting from change in sweeping scenario shown in red (reduction in efficiency) and blue (increase in efficiency).

APPENDIX F

Load Reduction Credit for PCBs in Stormwater Infrastructure Management Program

F.1 BACKGROUND

The BASMAA study *Evaluation of PCBs in Caulk and Sealants in Public Roadway and Storm Drain Infrastructure* (BASMAA, 2018) sampled caulk and sealant materials from public roadway and storm drain infrastructure around the Bay Area. The overall approach to the sampling program was to work cooperatively with multiple Bay Area municipal agencies to identify public right-of-way locations where PCBs were potentially used in caulk or sealant applications on roadway and storm drain infrastructure. These locations were identified primarily based on the time period that the infrastructure was originally constructed and/or repaired, with a focus on the 1970's - the most recent time period PCBs were still in widespread use. The project team collected 54 caulk or sealant samples from public infrastructure in these locations; 11 of these were collected from concrete bridges or overpasses. The Project Team then reviewed the information collected about each sample to determine how to group the samples for compositing prior to PCBs analysis. A total of 20 composite samples were then analyzed for PCBs concentrations. Ten of these composites were associated with concrete roadways, sidewalks, or bridges.

F.2 TOTAL ESTIMATED PCBS LOAD IN OLDER BRIDGES

The U.S. Department of Transportation Federal Highway Administration National Bridge Inventory (USDOT, 2019) was used to estimate the total potential PCBs load contained in older bridges located within the jurisdictions subject to the MRP.

F.2.1 Equations Used to Estimate PCBs Load

The equation used to estimate the total PCBs load contained in bridges built and/or reconstructed prior to 1981 within the jurisdictions subject to the MRP is as follows:

$$\text{Total Load}_{\text{PCBs, Bridges}} = \text{Density}_{\text{sealant}} * \text{Concentration}_{\text{PCBs}} * \sum \text{Volume}_{\text{sealant, bridges}}$$

Where:

$\text{Density}_{\text{sealant}}$ = average sealant density [kg/m^3]

$\text{Concentration}_{\text{PCBs}}$ = empirically derived concentration of PCBs [mg/kg]

$\sum\text{Volume}_{\text{sealant, bridges}}$ = Volume of sealant in all applicable bridges [m^3]

The volume of joint sealant was calculated using an assumed cross-section of sealant, multiplied by the assumed length of applied sealant:

$$\text{Volume}_{\text{sealant, bridges}} = \text{Cross-Section}_{\text{sealant}} * \text{Length}_{\text{sealant}}$$

Where:

$\text{Cross-Section}_{\text{sealant}}$ = Cross-section of applied sealant

$\text{Length}_{\text{sealant}}$ = Length of applied sealant

F.2.2 Data Used to Estimate Load

Data used to estimate load were obtained from BASMAA, 2018; a study of Bay Bridge sealant summarized by Hardeep Takhar of the California Department of Transportation (Caltrans) in 2013; and bridge dimensional information available from the National Bridge Inventory (USDOT, 2019). A summary of the data inputs is provided in Table F-1 below.

Table F-1: Bridge Load Calculation Data Inputs

Input	Result	Units	Source
Density of Sealant	1,100	kg/m^3	Takhar, 2013
Cross-Section of Sealant	1	square inch	Caltrans, 2007
PCBs Concentration	184	mg/kg	See Section 2.2.1

The derivation of the representative concentration of PCBs in sealant applied to bridges is described below.

F.2.2.1 PCBs Concentration

In order to compute a reasonable estimate of the expected PCBs concentration in caulking material in bridges in the MRP area, a data set consisting of 20 composite samples from BASMAA (2018) and four grab samples from the demolition of the Bay Bridge (Takhar, 2013) was analyzed.

Of the 20 BASMAA composite samples, 10 were identified as representative of caulking used on bridges based on the location from which the samples were taken (i.e., five of the composite samples were taken from bridges and five were from concrete roadway surfaces, sidewalks, and curbs and gutters). The remaining composite samples were judged to be non-representative, as they were taken from storm drain structures, asphalt roadways, metal pipes, and electrical utility poles and boxes. Table F-2 below summarizes the BASMAA study results for the concrete roadway, sidewalk, and bridge composite samples (BASMAA, 2018). Table F-3 summarizes the Bay Bridge caulk measurements (Takhar, 2013).

Table F-2: Sample Descriptions and PCBs Concentrations for Roadway and Bridge Composite Samples from the BASMAA Regional Infrastructure Caulk and Sealant Sampling Program (BASMAA, 2018)

Composite ID	Total PCBs (mg/kg)	Type of Structure(s) Sampled	Caulk/Sealant Application	Sample Appearance (Color/ Texture)	# of samples in composite	Sample ID's in composite	Structure Construction Date
A	4,967	Concrete Bridge	Caulk between expansion joints	Black Pliable Foam	2	10	1960-70's
						13	<1960
B	4,150	Concrete Bridge	Caulk between expansion joints	Black Pliable	3	9	1960-70's
						30	1960-70's
						31	<1960

Composite ID	Total PCBs (mg/kg)	Type of Structure(s) Sampled	Caulk/Sealant Application	Sample Appearance (Color/ Texture)	# of samples in composite	Sample ID's in composite	Structure Construction Date
C	0.78	Concrete Bridge	Caulk between expansion joints	Brown Fibrous	2	20	1960-70's
						26	1960-70's
D	0.70	Concrete Bridge	Sealant between concrete surfaces or between concrete and wood surface	Black Hard/Brittle	3	27	<1960
						29	1960-70's
						32	<1960
E	ND	Concrete Roadway Surface	Caulk between expansion joints	Black Hard/Brittle	5	35	<1980
						36	<1980
						37	<1980
						38	<1980
						39	<1980
F	ND	Concrete Sidewalk	Caulk between expansion joints	Black Hard/Brittle	3	2	<1960
						7	<1960
						46	<1980
G	ND	Concrete Sidewalk	Caulk between joints	Brown Fibrous	2	16	1960-70's
						17	1960-70's
H	ND	Concrete Sidewalk /Curb/Gutter	Caulk between joints	White/Gray Hard/Brittle or Pliable	3	1	<1980
						8	1960-70's
						18	1960-70's
I	0.06	Concrete Sidewalk /Curb/Gutter	Crack Sealant	White Hard/Brittle or White Pliable	2	23	<1980
						24	<1980
S	2.5	Concrete Bridge	Prefabricated joint filler	Black Pliable	1	12	<1960

A photo log of the samples taken from concrete bridges is provided in Attachment 1.

Table F-3: Concentrations of PCBs in Caulks Measured from the Bay Bridge

Description	Result (mg/kg)
PCBs Concentration (Bay Bridge Upper Roadway Sample)	1.01
PCBs Concentration (Bay Bridge Upper Roadway Sample)	1.65
PCBs Concentration (Bay Bridge Upper Roadway Sample)	0.705
PCBs Concentration (Bay Bridge Roadway Barrier Wall)	3.71
Bay Bridge Average Concentration	1.77

Source: Takhar, 2013

The complete dataset (i.e., results summarized in Table F-2 and F-3 and other non-representative samples) contains 10 non-detect (all in the BASMAA (2018) dataset) and 14 detected values.

After removing the 10 data points considered unrepresentative of bridges, the representative dataset contains 4 non-detect and 10 detected values (i.e., Table F-2 and Table F-3 summarized values). For the purposes of this analysis, both the complete and the presumed representative subset of the PCBs-in-caulk datasets were analyzed independently.

The non-detect values were imputed using a regression-on-order statistics method prior to estimating summary statistics using a maximum likelihood estimation approach as described in the sections below.

F.2.2.2 Handling Censored (Non-Detect) Results

Since estimation of common descriptive statistics of censored datasets can be heavily biased with simply substituted values, a robust regression-on-order statistics (ROS) method, as described by Helsel and Cohn (1988), was utilized to provide probabilistic estimates of non-detects (NDs). When applying the ROS method, ND values are imputed based on their plotting positions relative to the probability distribution estimated from the detected data. Imputed values are always less than their detection limits, but if the dataset includes multiple detection limits, some imputed values may be larger than some of the detected values. For the PCBs-in-caulk dataset, method detection limits (MDLs) for individual samples were not reported, but an overall MDL of 0.05 µg/kg was included in the BASMAA report and NDs are only reported for samples when every individual congener was not detected.

Maximum Likelihood Estimation

The lognormal probability distribution is often used to represent positively skewed contaminant concentrations (Singh et al., 1997). As such, the PCBs-in-caulking dataset has been assumed to arise from a population that is lognormally distributed, which implies that the standard deviation is proportional to the mean and the data are bounded by zero. A random variable, x, is said to be lognormally distributed if the distribution of $y = \ln(x)$ is normally distributed with a mean, μ_y, and variance, σ_y^2. The mathematical equation for lognormal distribution is:

$$f_x(x) = \frac{1}{\sqrt{2\pi}\sigma x}\exp\left[-\frac{1}{2}\left(\frac{lnx-\mu}{\sigma}\right)^2\right] \; x > 0 \qquad \textbf{Equation 1}$$

Where:

- μ is mean of the untransformed random variable x,
- σ^2 is the variance of the untransformed random variable x, and
- x is the variable of interest.

The lognormal distribution parameters of x are related to the normal parameters of y with the following equations:

$$\mu_x = \exp\left(\mu_y + 0.5\sigma_y^2\right) \qquad \textbf{Equation 2}$$

$$\sigma_x{}^2 = \mu\sqrt{\exp(\sigma_y^2) - 1} \qquad \textbf{Equation 3}$$

When a dataset is a random sample from a lognormal distribution, the Maximum Likelihood Estimate (MLE) of the parameter, μ_y, is simply the sample mean of the log-transformed data

(Singh et al., 1997). Similarly, the MLE of the parameter, σ_y^2, is the sample variance of the log-transformed data. However, for small sample datasets with a few extreme values, such as the PCB-in-caulk dataset, severe transformation bias can occur when estimating the arithmetic mean, μ_x, and arithmetic standard deviation, σ_x. Because of this, an alternative method for computing the expected value is needed as described below.

Advancing the assumption that the sample data arise from a lognormal distribution, a probability weighted mean can be computed as:

$$\hat{\mu}_x = \frac{\sum_{i=1}^{n}(x_i * w_i)}{\sum_{i=1}^{n} w_i} \qquad \textbf{Equation 4}$$

Where:

- $\hat{\mu}_x$ is probability-weighted mean of the untransformed random variable x;
- x_i is the ith sample value; and
- w_i is weight of the ith sample value, which is assumed equal to the probability of occurrence, $p(x_i)$, and can be computed by fitting the data to a lognormal probability density function (PDF).

The lognormal PDF can be constructed by computing the theoretical percentiles and plotting against the probability of a standard lognormal PDF. Any percentile, P_k, of x can be computed using the parameters of y as follows:

$$P_k = \exp\left(\mu_y + z_k \sigma_y\right) \qquad \textbf{Equation 5}$$

Where:

- z_k is the kth percentiles of the standard normal distribution.

Results and Conclusions

As stated above, the available data was evaluated in two separate dataset configurations:

1. All data including the potentially unrepresentative values (*N = 24)*
2. Roadway and bridge-only data excluding the potentially unrepresentative values (*N = 14)*.

In both configurations, lognormal distributions were fit to datasets where the non-detect values had been imputed with ROS. Figure F-1 below shows lognormal probability plots along with a best-fit line demonstrating the lognormality of the data.

Table F-4 provides summary statistics after applying ROS to the datasets. As shown, the data mean and data median are significantly different, which again supports the lognormal distribution assumption. The arithmetic mean values computed from Equation 2, however, are unrealistic considering the values are larger than any of the sample values – this is a result of transformation bias. The probability weighted mean values are believed to be the most accurate representation of the central tendency of PCBs in caulk for bridges in the MRP area based on the two datasets because this adjusts for the likely probability of occurrence of the extreme values observed in the data while preserving all sample data in the calculation.

Figure F-2 and Figure F-3 show the PDFs of the best-fit lognormal distributions. Each observed or imputed value drawn along the PDF is used to indicate the probabilities of occurrence, which were used to determine the weights for the probability weighted mean values.

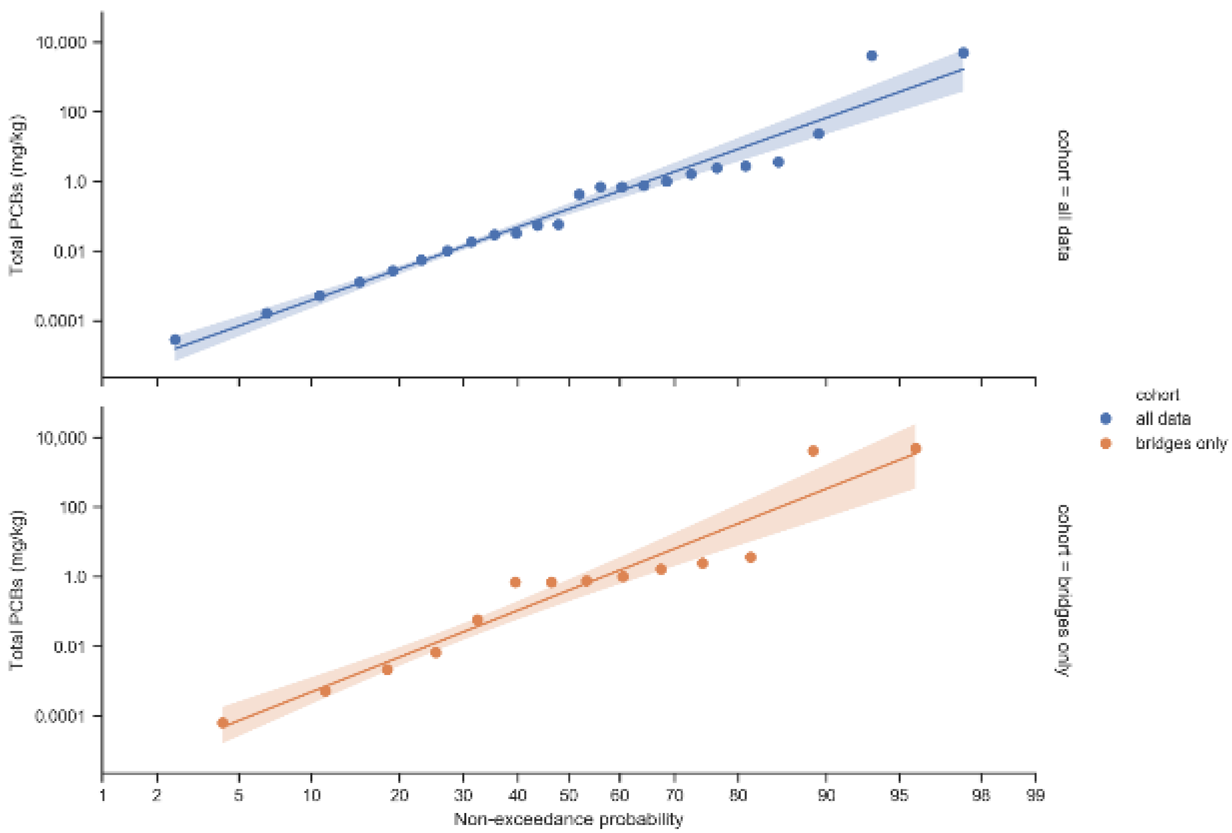

Figure F-1 - Lognormal probability plots. The shaded bands indicate the 95% confidence interval around the best-fit lines.

Table F-4: Summary Statistics

Statistic	Dataset	
	All Data	Roadway/Bridge Only
Sample Count (Total; NDs)	24; 10	14; 4
Data Mean, mg/kg	381	652
Data Standard Deviation, mg/kg	1292	1663
Data Median, mg/kg	0.25	0.74
Lognormal Mean (μy)	-1.82	-0.891
Lognormal Standard Deviation(σy)	4.57	5.02
Arithmetic Mean (μx), mg/kg	8,927	334,514
Probability Weighted Mean ($\hat{\mu}_x$), mg/kg	49.5	184

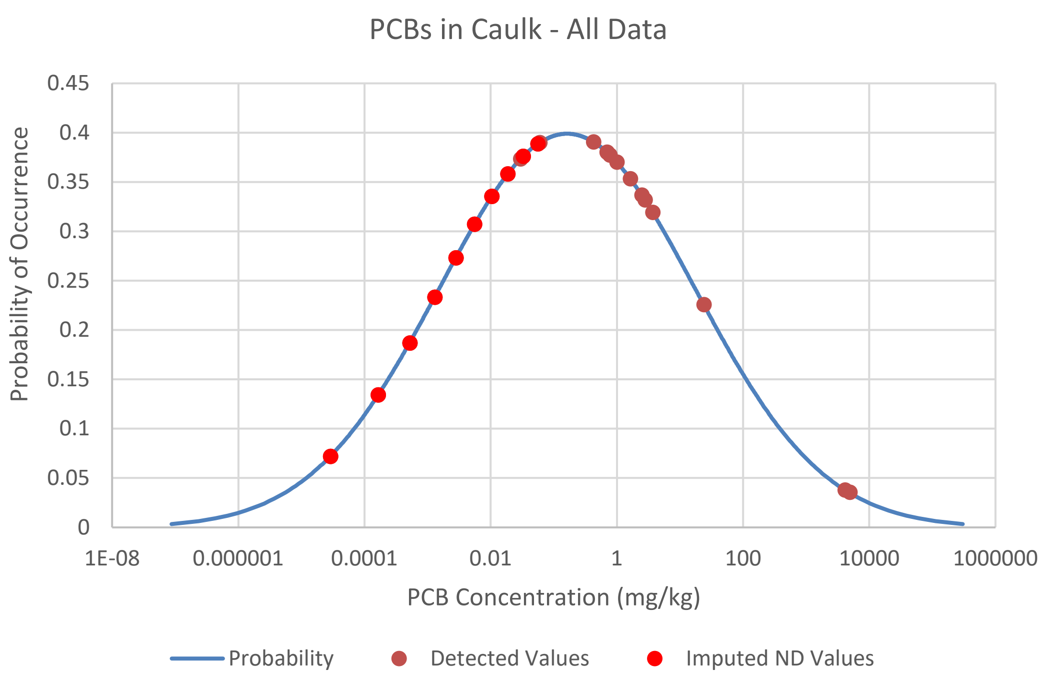

Figure F-2: Lognormal distribution plot for all available Total PCBs data, showing the weights of the detected and imputed values

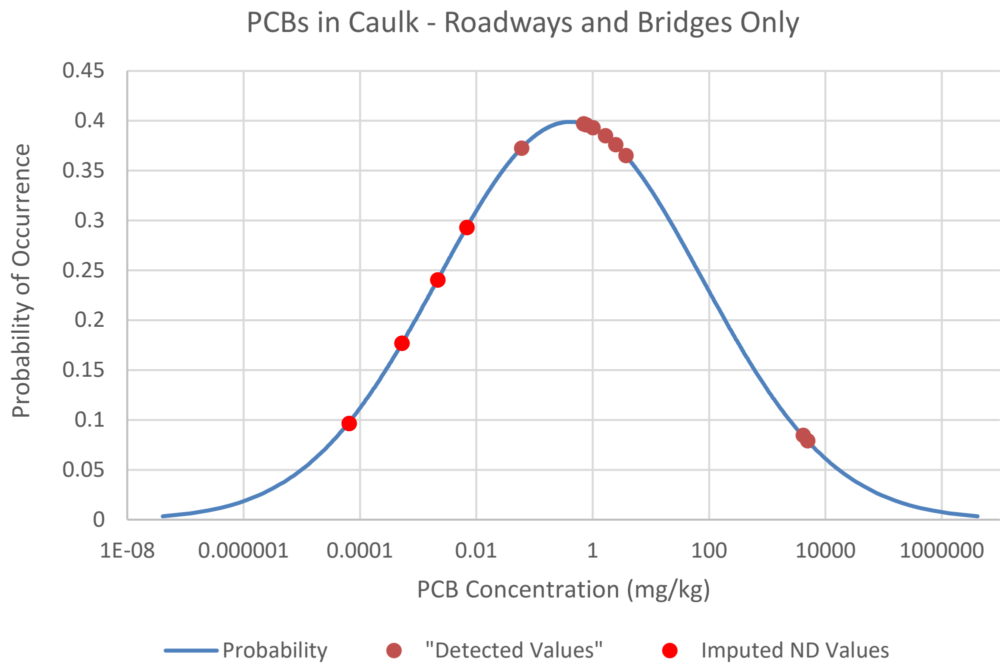

Figure 3: Lognormal distribution plot for Total PCBs data from roadways and bridges only, showing the weights of the detected and imputed values

F.2.2.2 Length of Applied Sealant

While it is evident from the BASMAA (2018) study photos that sealant may be applied to many concrete connections within any given bridge, this estimate focuses on the locations most exposed to weather and traffic and therefore most likely to leach into the environment. The sealant application locations of focus in this study include the bridge expansion joints (e.g., at connections between bridge spans), and the longitudinal seam between the bridge deck and the sidewalk and/or bridge side rail.

The federal bridge database used for this analysis contains information about dimensions of bridges located within the MRP jurisdictions. The length of sealant used to calculate total potential PCBs mass was estimated using database values as follows:

$$Length_{sealant,\ joints} = (N_{span} + 1) * Width_{deck}$$

Where:

N_{span} = The number of bridge spans

$Width_{deck}$ = Bridge deck width

Assuming there are seams along either side of the bridge at the sidewalk or wall, the longitudinal seam was calculated as:

$$Length_{sealant,\ longitudinal\ seam} = 2 * Length_{bridge}$$

F.2.3 Total Estimated PCBs Load in Bridges

A summary of the total calculated loads for bridges within the MRP coverage boundary, built and/or reconstructed prior to 1981, and specific bridge types[5], per the Nation Bridge Inventory, is provided in Table F-5.

Table F-5: Total Calculated Loads for Bridges within the MRP Area, Built and/or Reconstructed Prior to 1981

County	Total Sealant PCBs Mass - Joints Only (kg)	Total Sealant PCBs Mass - Joints and Longitudinal Seal (kg)	Number of Bridges
Alameda	3.8	11.2	340
Contra Costa	1.7	7.3	277
San Mateo	2.5	7.2	254
Santa Clara	3.7	10.1	473
Solano	0.9	3.2	133
Total	**12.6**	**39.0**	**1,477**

The average mass of PCBs in MRP bridges with the characteristics described, based on the calculation, is approximately 8.5 grams, accounting for joint sealant only, and 26 grams, accounting for both joint and longitudinal sealant.

F.3 LONG TERM LOAD REDUCTION ESTIMATE

F.3.1 Methodology

To estimate the load reduction associated with long-term bridge or expansion joint replacement, it is assumed that an ongoing PCBs release rate from bridge joints is mitigated through bridge joint maintenance and whole bridge replacement projects. The load reduction estimation is based on the assumption that PCBs in caulk are leaching from bridge joints and longitudinal seals over their lifetime. When that PCBs-containing caulk is replaced or removed through maintenance or replacement projects, the source of PCBs release is removed, and the associated annual released load is also removed. PCBs leaching from the material could occur through incremental wear or through larger damage (e.g., pieces of caulk torn out) over the lifetime of the caulk.

While volumetric or mass-based losses of joint seals over time were not found in literature, publications that describe joint maintenance and failure were reviewed to justify the assumption of leaching over time. Compression and strip seal type joints, which could potentially be expected to consist of PCBs-containing material, have an expected lifetime of 8 to 16 years, according to a survey conducted for an NCHRP study on bridge joints (NCHRP, 2016). Despite this recommended lifetime, an extrapolated rate of joint replacement in the Bay Area demonstrates that joints are being replaced at a much lower frequency. According to three

[5] 0 – Other; 01 – Slab; 02 – Stringer/Multi-beam or Girder; 03 – Girder and Floorbeam System; 04 – Tee Beam; 05 – Box Beam or Girders – Multiple; or 06 – Box Beam or Girders – Single or Spread.

Permittee preventative maintenance plans available on Caltrans' Highway Bridge Program funding website (Caltrans, 2019), approximately 3% of bridges meeting the characteristics described above are scheduled for joint replacement over the next five-year funding period. An additional 1.5% of bridges are scheduled for replacement over the same five-year period (presumptively replacing the joints). At this rate, replacing the joints via joint maintenance or bridge replacement projects in all 1,477 bridges would take over 110 years.

The concept that older, likely PCBs-containing joints persist in the older MRP bridges is borne out through the findings of the BASMAA (2018) study, which found very high PCBs concentrations in composite samples from a random selection of representative bridge infrastructure. This outcome is also consistent with a finding from a 2003 NCHRP report (NCHRP, 2003), which found through interviews with transportation agencies that "agencies indicated that they tend not to respond to joint problems unless there is a safety hazard or when the deck is being rehabilitated or replaced. Other than reactive efforts, joint repair and rehabilitation, in most agencies, is associated with deck rehabilitation." Additionally, while guidance documents typically define joint replacement needs in terms of visual degradation of the joint, along with other factors, the NCHRP study stated that agencies often defined failure of a deck joint as leakage, physical damage, or traffic hazard. These conditions could be taken to interpret that agencies are only replacing severely damaged or degraded joints (NCHRP, 2003).

Older joints could be considered more likely to leach into the environment, as the sealant material accumulates damage over time. Typical types of joint seal damage described by the Wyoming Department of Transportation, Aeronautics Division Airport Pavement Management Program (2020) include: (1) stripping of joint sealant, (2) extrusion of joint sealant, (3) weed growth, (4) hardening of the filler (oxidation), (5) loss of bond to the slab edges, and (6) lack or absence of sealant in the joint. These damage types are also consistent with those described in NCHRP (2016). Most of these damage types either directly refer to stripping of the sealant from the joint or create a condition in which the sealant is more likely to be released from the joint when subjected to traffic loads (i.e., conditions such as extrusion, hardening/becoming more brittle, loss of bond). Examples of damaged joint seals from this source are provided in Attachment 2.

F.3.2 Load Reduction Calculation

Lacking a literature-based release rate of sealant over time, two potential annual release rates are provided for the load reduction calculation. Based on the assumption that the joint seal may become degraded over time, it is possible that the sealant releases little during the initial operation period and more as the joint sealant ages. Another possible release pathway is through leaching into surrounding concrete and subsequent degradation of the concrete. Two potential average annual release rates (i.e., average over the life of the seal) were assumed to calculate an estimated load reduction from removing the joint seal – 1% and 0.5%. These average annual release rates were applied to the estimated mass for the 1,477 bridges meeting the identified age criteria (Table F-6). These releases would be eliminated through removal of the joint seal through joint replacement or bridge replacement.

Table F-6: Long-Term Load Reduction (i.e., Replacement of PCBs-Containing Joints in All Older Bridges)

County	Total Sealant PCBs Load Reduced - Joints Only (g/year)		Total Sealant PCBs Load Reduced - Joints and Longitudinal Seal (g/year)	
	1% annual loss rate over life	0.5% annual loss rate over life	1% annual loss rate over life	0.5% annual loss rate over life
Alameda	38	19	112	56
Contra Costa	17	8	73	37
San Mateo	25	12	72	36
Santa Clara	37	19	101	50
Solano	9	5	32	16
Total	126	63	390	195

This is the assumed load reduction by 2080, based on the assumption that all older joints will be removed/replaced within 100 years of installation (this is consistent with recent Caltrans replacement frequency calculated above).

F.4 REFERENCES

BASMAA, 2018. Evaluation of PCBs in Caulk and Sealants in Public Roadway and Storm Drain Infrastructure. August.

Caltrans, 2007. Revised Standard Plan RSP B6-21. Supersedes RSP B6-21, Page 258 of the Standard Plans Book dated July 2004.

Caltrans, 2019. HBP Listings – MTC. 1 November 2019. https://dot.ca.gov/programs/local-assistance/fed-and-state-programs/highway-bridge-program/hbp-listings/mtc

Helsel, D.R. and T.A. Cohn. 1988. *Estimation of descriptive statistics for multiply censored water quality data*. *Water Resource Res.,* Volume 24, 1997-2004.

National Cooperative Highway Research Program (NCHRP), 2003. NCHRP Synthesis of Highway Practice 319: Bridge Deck Joint Performance. Prepared by R. Purvis. Transportation Research Board, National Research Council. Washington, D.C.

NCHRP, 2016. Guidelines for Maintaining Small Movement Bridge Expansion Joints (Part I). Prepared by University of Delaware and P.J. Weykamp. Transportation Research Board, National Research Council. Washington, D.C.

Singh, A, Singh, A. and Engelhardt. 1997. *The Lognormal Distribution in Environmental Applications.* Technology Support Center Issue. U.S. EPA Office of Research and Development. EPA/600/R-97/006.

Takhar, 2013. E-mail titled "RE: 0120T4 SFOBB PCB Survey". Send to Derek Beauduy. 20 November 2013.

U.S. Department of Transportation Federal Highway Administration, 2019. National Bridge Inventory. Visited 24 March 2020.

Wyoming Department of Transportation, Aeronautics Division Airport Pavement Management Program, 2020. Joint Seal Damage. https://www.appliedpavement.com/hosting/wyoming/pavement-inspection/pci-review/distresses-pcc/joint-sealant-damage.html. Visited 9 April 2020.

Attachment 1: BASMAA Bridge Sample Photos

Composite A

Composite B

Composite S

Composite C

Composite D

Attachment 2: Images of Joint Seal Damage

Joint sealant damage is any condition that enables soil or rocks to accumulate in the joints or allows significant infiltration of water. Accumulation of incompressible materials prevents the slabs from expanding and may result in buckling, shattering, or spalling. A pliable joint filler bonded to the edges of the slabs protects the joints from accumulation of materials and also prevents water from seeping down and softening the foundation supporting the slab. Typical types of joint seal damage are: (1) stripping of joint sealant, (2) extrusion of joint sealant, (3) weed growth, (4) hardening of the filler (oxidation), (5) loss of bond to the slab edges, and (6) lack of absence of sealant in the joint..

Source: Wyoming Department of Transportation, Aeronautics Division Airport Pavement Management Program (https://www.appliedpavement.com/hosting/wyoming/pavement-inspection/pci-review/distresses-pcc/joint-sealant-damage.html)

Severity	Distress Example	Description
Low		Joint sealer is in generally good condition throughout the sample. Joint seal damage is at low severity if a few of the joints have sealer which has debonded from but is still in contact with the joint edge. This condition exists if a knife blade can be inserted between sealer and joint face without resistance.
Medium		Sealant needs replacement within two years. Joint seal damage is at medium severity if a few of the joints have any of the following conditions: (a) joint sealer is in place, but water access is possible through visible openings no more than 1/8 in (3 mm) wide. If a knife blade cannot be inserted easily between sealer and joint face, this condition does not exist; (b) pumping debris are evident at the joint; (c) joint sealer is oxidized and "lifeless" but pliable (like a rope), and generally fills the joint openings; or (d) vegetation in the joint is obvious, but does not obscure the joint opening.

Severity	Distress Example	Description
High		Joint sealer is in generally poor condition over the entire surveyed sample. Sealant needs immediate replacement. Joint seal damage is at high severity if 10% or more of the joint sealer exceeds limiting criteria listed above, or if 10% or more of sealer is missing.

APPENDIX G
Load Reduction Credit for Managing PCBs from Electrical Utilities Program

G.1 INTRODUCTION

Monitoring conducted over the past 15+ years by Bay Area stormwater programs demonstrates municipal stormwater runoff is a source of PCBs to the Bay. PCBs were historically used in many applications, including electrical utility equipment and caulks and sealants used in building materials. However, the greatest use by far was in electrical equipment such as transformers and capacitors (McKee et al. 2006). Existing electrical utility equipment, which is often located in the public right-of-way (ROW), may still contain PCBs that can be released to the MS4 when spills and leaks occur. Due to past leaks or spills of PCBs oil from electrical equipment, properties owned and operated by electrical utilities may potentially have elevated concentrations of PCBs in surrounding surface soils that can be released to the MS4. Because the cumulative releases of PCBs-laden soils from these properties, and spills or leaks of PCBs oils from electrical equipment to MS4s across the Bay Area may occur at levels that exceed the 2 kg per year TMDL waste load allocation, this potential source of PCBs may limit the ability of municipalities to meet the goals of the PCBs TMDL for the Bay.

Electrical utility equipment in both the transmission and distribution systems are distributed across the MRP region. In the past, PCBs were routinely used in electrical utility equipment that contained dielectric fluid as an insulator. This is because prior to the 1979 PCBs ban, dielectric fluid was typically formulated with PCBs due to a number of desirable properties (e.g., high dielectric strength, thermal stability, chemical inertness, and non-flammability). Electrical equipment containing dielectric fluid is typically identified as Oil-Filled Electrical Equipment (OFEE). McKee et al. (2006) estimated that between 1950 and 1990, roughly 8 million kg of PCBs were used in electrical transformers and large capacitors in the Bay Area (McKee et al. 2006). How much of this mass was released to the environment and how much remains in electrical equipment distributed across the Bay Area today is unknown. Any OFEE that contained PCBs in the past could still potentially contain PCBs today because the 1979 ban of PCBs did not require the immediate removal of PCBs from current applications. Electrical utilities have made substantial efforts over the past 35+ years to reduce the amount of PCBs still used in their applications in the Bay Area. But despite these removal efforts, PCBs may still be found in older and refurbished OFEE, and particularly OFEE located throughout the distribution system.

There are hundreds of thousands of pieces of OFEE in public rights-of-way and at hundreds of electrical sub-station facilities across the MRP region. Some portion of these OFEE that are older and/or refurbished may contain (or contained in the past) dielectric fluids with PCBs at concentrations that are of concern if released to MS4s. Due to their large quantity, dispersed nature, and the difficulty in tracking and monitoring discharges, Permittees are limited in their ability to implement and/or enforce consistent and appropriate control measures to reduce releases of PCBs from this source category. This creates a potential missed opportunity to account for past and ongoing removal of PCBs-containing OFEE which has been and continues to reduce loads of PCBs from MS4s to the Bay.

G.2 DESKTOP ANALYISIS OF MUNICPALLY-OWNED ELECTRICAL UTILITY DATA

In 2019-2020, BASMAA conducted a desktop analysis to better understand the extent and magnitude of municipally-owned electrical utility equipment as a source of PCBs to urban stormwater runoff, and document measures already taken or underway to remove PCBs-containing oils and electrical equipment from active service across the Bay Area. The data analysis and major results are summarized here. Additional details are available in the full BASMAA report (BASMAA 2020).

G.2.1 Overview of Municipally-Owned Electrical Utilities

In the MRP Area, there are five municipally-owned (public) electrical utilities, including:

1. Alameda Municipal Power
2. City of Palo Alto Utilities
3. Pittsburg Power Company, doing business as (dba) Island Energy – City of Pittsburg
4. Port of Oakland
5. Silicon Valley Power - City of Santa Clara

Three of these public utilities participated in the BASMAA project and submitted data on their OFEE inventories and spill response protocols for evaluation, including: City of Palo Alto Utilities (CPAU), Pittsburg Power Company dba Island Energy (Island Energy) – City of Pittsburg, and Silicon Valley Power (SVP) – City of Santa Clara.

Additional information about each of the three participating municipally-owned electrical utilities and the information provided on OFEE in their systems is presented below.

G.2.1.1 City of Palo Alto Utilities

The City of Palo Alto Utilities (CPAU) have been operating a municipal electric power system in that city for over 100 years. CPAU serves the City of Palo Alto with an area of approximately 16,640 acres (including ~11,000 acres of urban area and ~5,500 acres of open space) and a population of approximately 67,082 people.

CPAU provided data on their inventory of OFEE through December 2019, including counts of equipment that are currently active in the system and equipment that have been removed from the system. OFEE counts were provided by the following equipment types:

- Poletop transformers
- Padmount single phase transformers
- Padmount three phase transformers
- Padmount substation transformers
- Underground commercial and residential distribution transformers

- Regulators
- Padmount switches
- Vault/box switches

For each type of equipment, CPAU provided an average volume of oil in each piece of equipment. The OFEE counts were further divided into the following categories:

- All active OFEE (equipment that are currently in active service within electrical transmission or distribution systems);
- Active OFEE that were purchased or installed prior to 1985 (pre-1985 OFEE);
- All inactive OFEE (equipment that have been removed from service);
- Inactive pre-1985 OFEE that were removed from service prior to 2002;
- Inactive pre-1985 OFEE that were removed from service in 2002 or later.

CPAU did not provide any data on measured PCBs concentrations in their OFEE inventory. However, they did identify OFEE that were labeled as "Non-PCBs" by the manufacturer.

G.2.1.2 Silicon Valley Power

Silicon Valley Power (SVP) has been operating in the City of Santa Clara for more than 100 years. As of December 2019, SVP includes 25 substations, 55 miles of transmissions lines, and 186 miles of overhead distribution lines. The total coverage area is 11,782 acres, and the population served is 129,488 people.

SVP provided data on their inventory of OFEE through December 2019, including counts of equipment that are currently active in the system and equipment that have been removed from the system. OFEE counts were provided by the following equipment types:

- Poletop transformers
- Padmount single phase transformers
- Padmount three phase transformers
- Padmount substation transformers
- Underground commercial and residential distribution transformers
- Regulators
- Padmount switches
- Vault/box switches

For each type of equipment, SVP provided an average volume of oil in each piece of equipment. The OFEE counts were further divided into the following categories:

- All active OFEE (equipment that are currently in active service within the electrical transmission or distribution systems);
- Active OFEE that were purchased or installed prior to 1985 (pre-1985 OFEE);
- All inactive OFEE (equipment that have been removed from service);
- Inactive pre-1985 OFEE that were removed from service prior to 2002;
- Inactive pre-1985 OFEE that were removed from service in 2002 or later.

SVP also provided equipment counts and oil volumes for a number of OFEE that comprised approximately 12% of the oil mass in their inventory, for which no information on equipment status (active or inactive) and no information on equipment age (pre-1985 or post-1985) were available at the time this report was prepared. These data were excluded from the main analysis. However, a sensitivity analysis was conducted in order to understand potential implications of excluding these data. The results of the sensitivity analysis are presented in Section G.2.3.4. Based on those results, the unknown data were included in the estimated ranges of PCBs mass and stormwater loads.

SVP did not provide any data on measured PCBs concentrations in their OFEE inventory.

G.2.1.3 Pittsburg Power Company, Island Energy

Pittsburg Power Company is a joint powers authority and department within the City of Pittsburg, California. Since 1997, Pittsburg Power has been operating an electric utility distribution system at Mare Island in Vallejo under the name “Island Energy”. Mare Island was formerly the location of a US Naval shipyard that was decommissioned in 1996. Following decommissioning, the Pittsburg Power Company acquired the electrical utility distribution rights on Mare Island from the US Navy. The distribution system on Mare Island that is operated by Island Energy consists of one substation and approximately 11 miles of distribution lines that serve an area of ~1,200 acres. The Mare Island zip code has a population of approximately 900 people.

Island Energy provided detailed inventories for the transformers that were part of both the historic (US Navy) inventory and the current (Island Energy) inventory of OFEE on Mare Island. The historic inventory documents each piece of OFEE that was part of the US Naval shipyard on Mare Island until 1996. At that time, the US Navy removed the bulk of pre-1985 OFEE and sent them to hazardous waste facilities for proper disposal. However, some pre-1985 OFEE remained on the island. The current inventory identifies each piece of OFEE on Mare Island that has been operated by Island Energy since 1997 through December 2019. The data provided in both the current and historic inventories includes the volume of oil, installation date, and (if applicable) removal date for each transformer in the historic or current system on Mare Island. In addition, measured concentrations of PCBs were provided for most OFEE in these inventories. Island Energy noted that there are gaps in the historic records, and the data provided may be incomplete. The current inventory identifies all OFEE that have been or are currently active and operated by Island Energy on Mare Island between 1997 and 2019 (i.e., since Island Energy began operating the electrical distribution system on Mare Island). The data analysis focused on the PCBs-containing OFEE in the historic and current inventories.

G.2.2 Overall Approach and Methods

The overall goal of the analysis of municipally-owned electrical utility OFEE inventories was to develop improved estimates of both the load of PCBs to stormwater from OFEE, and the load reductions that have been achieved over time due to ongoing equipment maintenance and replacement programs. The data analysis was also intended to provide data inputs that could be used to calculate the PCBs load reductions achieved since the start of the PCBs TMDL, and the expected PCBs load reductions in the future due to the ongoing removal and proper disposal of PCBs-containing OFEE. To accomplish these goals, the project evaluated the OFEE inventories provided by participating municipally-owned electrical utilities to characterize the magnitude of PCBs-containing OFEE in these systems and document the rate of removal of PCBs-containing OFEE over time. The data were used to calculate the annual average removal rates of PCBs-containing OFEE from participating municipally-owned electrical utility systems since the start of the PCBs TMDL (i.e., 2002). This information was then scaled-up to the larger MRP area in order to provide a rough, first-order estimate of the potential magnitude of the current OFEE load of PCBs to stormwater across the area.

G.2.2.1 OFEE Inventory Data Analysis Approach and Assumptions

The OFEE inventory data were analyzed to generate estimates of the following:

- The potential mass of PCBs in active OFEE within each municipally-owned electrical utility system at the start of the PCBs TMDL (i.e., 2002) and currently (i.e. 2020).
- The potential mass of PCBs in OFEE that has been removed from each of these systems due to ongoing maintenance and replacement programs before and after 2002.
- The annual average reduction rate achieved since the start of the PCBs TMDL due to removal of PCBs-containing OFEE from these systems.
- The potential PCBs stormwater load from OFEE in these systems at the start of the PCBs TMDL and currently.
- The expected PCBs stormwater load reductions in the future due to continued removal of PCBs-containing OFEE from these systems.

Because information on measured PCBs in these OFEE was limited, the mass of oil in OFEE was used as the primary metric to characterize OFEE within each system, to estimate the magnitude of potentially PCBs-containing OFEE in each system, and to calculate equipment removal rates. The age of the OFEE, based on the purchase or installation date provided, was used as the primary metric to identify potentially PCBs-containing equipment as follows:

- Pre-1985 OFEE. All equipment that was installed prior to 1985 (i.e., pre-1985 OFEE) were assumed to potentially contain PCBs. 1985 was selected as the appropriate cut-off date to identify equipment that may contain PCBs because the installation of PCBs-containing equipment that had been stockpiled prior to the 1979 PCBs ban continued for several years after the ban[6].

- Post-1985 OFEE. All equipment installed after 1985 (i.e., post-1985 OFEE) were assumed to contain zero PCBs.

The potential mass of PCBs in pre-1985 OFEE was calculated from the mass of oil in these OFEE multiplied by a range of assumed PCBs concentrations in that oil. The PCBs concentrations in all pre-1985 OFEE were based on the following assumptions:

- Measured PCBs concentrations were used, if available.
- If no PCBs measurement data were provided, the range of PCBs concentrations was estimated as follows:
    - Pre-1985 OFEE with "PCBs" labels are assumed to have PCBs concentrations ≥ 500 ppm (i.e., PCBs Transformers). However, because PCBs transformers must be registered with the US EPA transformer registry, and none of the participating municipally-owned utilities have registered any PCBs transformers in this database, all PCBs concentrations in any equipment in the current OFEE inventories were assumed to be less than 500 ppm.
    - Pre-1985 OFEE with "Non-PCBs" on the label have PCBs concentrations < 50 ppm. All OFEE with these labels were assumed to have PCBs between 1 and 49 ppm, unless otherwise noted.
    - Pre-1985 OFEE that were not labeled, or that did not have measured PCBs concentrations were assumed to contain PCBs between 50 and 499 ppm.

Because this report is focused on OFEE that contain or may contain PCBs, the data analysis focused primarily on pre-1985 OFEE.

G.2.2.2 Data Analysis Methods

Analysis of the OFEE inventory data proceeded through the following seven steps:

1. Calculate the total mass of oil in all active OFEE within each system and the total mass of oil in active pre-1985 OFEE. Use this information to estimate the mass of oil and current abundance of potentially PCBs-containing OFEE within each system.

The total mass of oil in all active OFEE was calculated from the volume of oil in each piece of equipment multiplied by the density of the oil. The OFEE inventories provided by the participating municipally-owned electrical utilities provided either the actual volume of oil in each piece of equipment in their inventory, or the average volume of oil per piece of equipment for each type of equipment and the total counts of active equipment of that type. The density of

[6] Personal communication, Sanchez 2016. This assumption is based on statements made to Regional Water Board staff at a meeting with PG&E representatives that equipment stockpiled prior to the 1979 ban continued to be put into service after the ban until voluntary replacement programs were instituted around 1985.

the oil in all OFEE was based on the density of highly refined mineral oil used as a dielectric fluid in transformers of 0.9 mg/l[7].

Pre-1985 OFEE were identified based on information provided by the municipally-owned electrical utilities on either the installation date for each piece of equipment in their inventory, or the counts of all equipment within each category that were installed before 1985 and are currently active in their system.

2. Calculate the mass of oil in pre-1985 OFEE that has been removed from active service since the start of the PCBs TMDL in 2002.

Only pre-1985 OFEE were included in this calculation because this category comprises all OFEE that may contain PCBs. Each participating municipally-owned electrical utility provided slightly different data on equipment removal dates. Both CPAU and SVP provided direct counts of pre-1985 OFEE within each equipment category that were removed from service in 2002 or later. Island Energy identified all pre-1985 OFEE in their current inventory as either active or inactive as of 2019 but did not provide removal dates for inactive equipment. However, Island Energy's current OFEE inventory only includes OFEE that were active in 1997. At this step in the process, in order to simply this calculation and provide information needed for Step #3, this calculation assumed all equipment in Island Energy's current inventory were active until at least 2002 (i.e., all inactive OFEE were removed from service in 2002 or later).

3. Calculate the overall equipment removal rate and annual average equipment removal rate for pre-1985 OFEE since the start of the PCBs TMDL in 2002. Use this estimate to calculate the future date by which all pre-1985 OFEE will be removed from each participating municipally-owned electrical utility system.

The overall equipment removal rates for pre-1985 OFEE that were achieved between 2002 and 2019 were calculated based on the total mass of oil in pre-1985 OFEE that were removed from each system during that time period, divided by the total mass of oil in all pre-1985 OFEE that were active in 2002. The annual average removal rates were then calculated by dividing the overall removal rate by the number of years between 2002 and 2019 (17 years).

For CPAU and SVP, the overall removal rates since the start of the PCBs TMDL in 2002 were calculated directly from the data provided on removals between 2002 and 2019. However, because of the way the data were provided for Island Energy, an additional step was needed to estimate the overall removal rate since 2002. Island Energy identified all equipment in their current inventory, which spans the time period between 1997 and 2019, as active or inactive in 2019. However, specific removal dates for inactive equipment in the current inventory were not provided. Therefore, in order to estimate the overall removal rate since 2002, first, the annual average removal rate between 1997 and 2019 was calculated by dividing the overall removal rate for this period by the number of years between 1997 and 2019 (22 years). This annual average

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[7] Based on the reported density of Shell Diala Oil AX manufactured by SOPUS Products. Island Energy identified this as the dielectric oil used in the large transformers at their substation and provided a Material Safety Data Sheet (MSDS) for this product in their Spill Prevention, Control and Countermeasure (SPCC) plan.

removal rate was then multiplied by the number of years between 2002 and 2019 (17 years) to estimate the overall removal rate since the start of the PCBs TMDL in 2002.

Both the annual average removal rates and the overall removal rates since 2002 were compared across participating municipally-owned utilities. These data were also compared with the rates proposed in the accounting methodology for calculating the load reductions due to ongoing removal of PCBs-containing OFEE since the start of the PCBs TMDL and into the future. These removal rates were also used to estimate the future date by which all pre-1985 OFEE will be removed from each system. This calculation assumes the annual average removal rate for each system that has been achieved since 2002 will continue until all pre-1985 OFEE have been removed from each system. The starting point for this calculation was the mass of oil in all pre-1985 OFEE that were active in each system in 2020 (calculated in step #1). This 2020 value was then multiplied by the annual average removal rate for each system to estimate the total mass of pre-1985 OFEE oil removed each year. The number of years to reduce this mass to zero was then estimated by dividing the total mass of oil in active pre-1985 OFEE in 2020 by the mass of oil that would be removed each year.

4. Calculate the potential range of PCBs mass in active OFEE in 2020.

The potential range of PCBs mass (kg) in currently active pre-1985 OFEE was estimated for each system based on the total mass of oil in active pre-1985 OFEE in 2020 multiplied by the measured or assumed PCBs concentrations based on previously described assumptions (see Section 4.2.1).

5. Calculate the 2002 and 2020 loads of PCBs to stormwater from OFEE in the participating municipally-owned electrical utility systems and load reductions achieved over time due to equipment removals.

The starting point for this calculation was the current PCBs mass in active OFEE (step #5 above) for each participating municipally-owned electrical utility system. The following assumptions used by McKee et al., (2006) were then applied to estimate the fraction of PCBs in OFEE that are released to MS4s annually.

- 0.05% was estimated to leak from transformers and 0.35% from large capacitors each year (Harrad 1994, EIP Associates 1997); For this analysis, the value for transformers was used for all OFEE;
- When leaks occur, 99% of the materials leaked are cleaned up and only 1% remain on erodible surfaces and available for wash off.

6. Estimate the stormwater loads from OFEE across the larger MRP area and the potential load reductions that can be achieved through continued equipment removal.

This calculation extrapolated the stormwater loads estimated for the participating municipally-owned electrical utility system OFEE (developed in step #5) to the larger Bay Area.

G.2.3 Data Analysis Results

G.2.3.1 Summary of Municipally-Owned Electrical Utility Data

Figure G.1 presents a summary of the distribution of OFEE in each of the participating municipally-owned electrical utility systems' inventories. Additional information about these distributions is provided in the following sections.

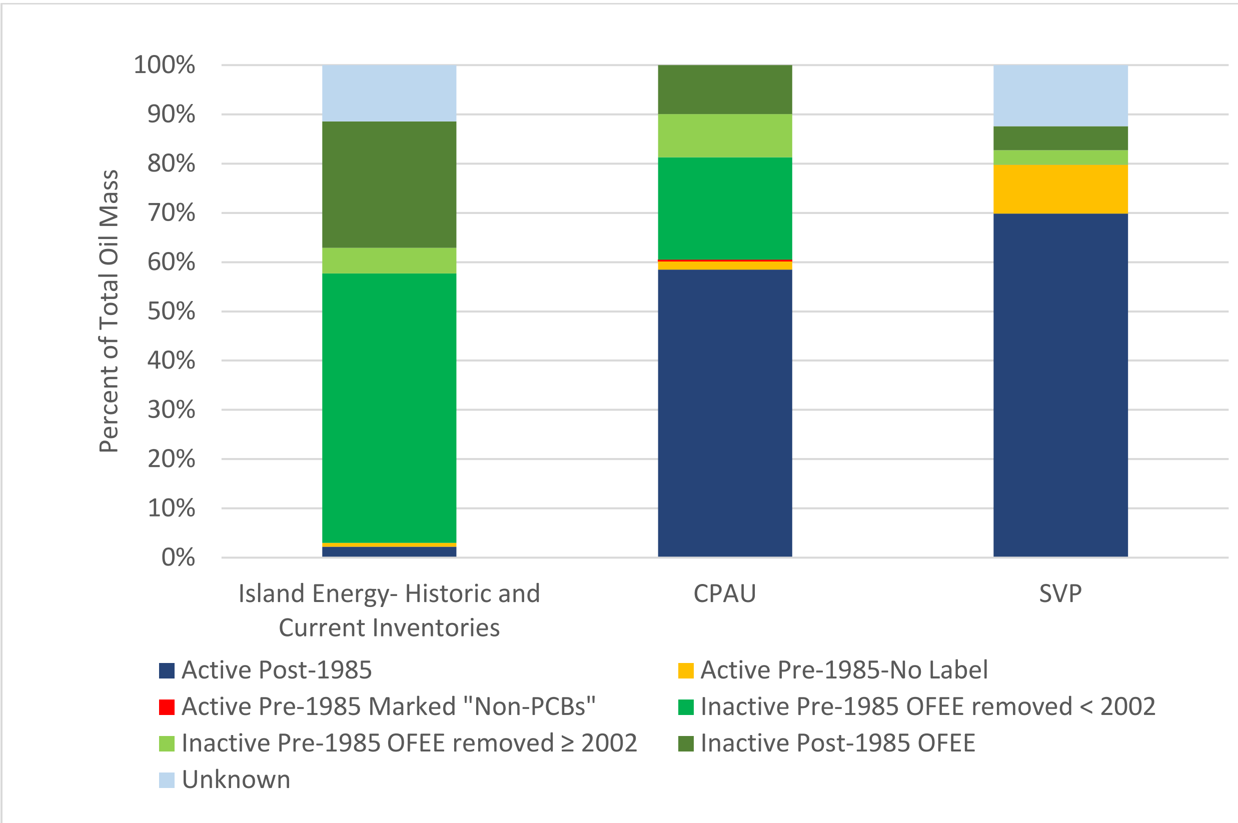

Figure G-1: Distribution of the mass of oil in oil-filled electrical equipment (OFEE) in three municipally-owned electrical utility systems.

G.2.3.2 Active Equipment - including both Pre-1985 and Post-1985 OFEE

Table G-1 presents the mass of oil in all OFEE that are currently active in each participating municipally-owned electrical utility system, divided between pre-1985 OFEE and post-1985 OFEE. Where available, the data are also presented by equipment type. Across all 3 systems, there are more than 4.8 million kilograms (kg) of oil in active OFEE.

Combined, there are nearly 500,000 kg of oil in active pre-1985 OFEE in these systems, which is 10% of the oil in active OFEE (Table G-1). CPAU has the lowest abundance of active pre-1985 OFEE oil, which comprises 3.4% of their OFEE. Approximately 12% of SVP's active equipment, and 25% of Island Energy's active equipment are comprised of pre-1985 OFEE. Additional pre-1985 OFEE may be active in the system that cannot be verified at this time. Detailed equipment type was not provided by Island Energy, but for both CPAU and SVP, 64% of the pre-1985 OFEE oil is contained in padmount transformers, and about 25% is contained within pole-top transformers. The remainder is either in underground transformers or switches.

Table G-1: Mass of dielectric oil in oil-filled electrical equipment (OFEE) that are currently active in three municipally-owned electrical utility systems.

Utility System	Equipment Type	Oil in ACTIVE OFEE (kg)			Percent of Active OFEE that are pre-1985
		Pre-1985 OFEE	Post-1985 OFEE	TOTAL	
City of Palo Alto Utilities (CPAU)	Padmount Single Phase Transformer	988	57,798	58,786	1.7%
	Padmount Three Phase Transformer	33,336	609,353	642,689	5.2%
	Poletop Transformer	4,923	121,608	126,531	3.9%
	Regulator	0	920	920	0%
	Underground Commercial Distribution Transformer	0	108,560	108,560	0%
	Underground Residential Distribution Transformer	204	62,584	62,789	0.3%
	Padmount Oil Switch	0	1,090	1,090	0%
	Padmount Vacuum Switch	0	99,038	99,038	0%
	Vault/Box Oil Switch	0	0	0	0%
	Vault/Box Vacuum Switches	0	63,027	63,027	0%
	Subtotal - CPAU	**39,452**	**1,123,977**	**1,163,429**	**3.4%**
Silicon Valley Power (SVP) – City of Santa Clara[1]	Padmount Single Phase Transformer	2,044	23,201	25,245	8.1%
	Padmount Three Phase Transformer	189,333	1,147,357	1,336,690	14%
	Poletop Transformer	111,551	139,338	250,889	44%
	Underground Residential Distribution Transformer	0	1,635	1,635	0%
	Padmount Oil Switch	7,645	9,444	17,089	45%
	Padmount Vacuum Switch	51,880	154,999	206,879	25%
	Padmount Vacuum-Disconnect Switch	0	249,764	249,764	0%
	Padmount Substation Transformer	91,985	1,460,593	1,552,578	6%
	Subtotal - SVP	**454,439**	**3,186,330**	**3,640,76**	**12%**
Island Energy[2]	**Current Inventory of Transformers**	**3,669**	**10,882**	**14,551**	**25%**
TOTAL (All Systems Combined)		**497,560**	**4,321,189**	**4,818,749**	**10%**

[1]SVP identified incomplete records for OFEE that contain approximately 566,000 kg or oil. The current status of these OFEE (active or removed) and the installation dates were unavailable at the time of this report. Therefore, these OFEE were not included in any of the totals above.

[2]Since 1997, Pittsburg Power Company has been operating the electrical distribution system on Mare Island in the City of Vallejo under the name Island Energy.

G.2.3.3 Pre-1985 OFEE Removed from Active Service

Table G-2 presents the total mass of oil in all pre-1985 OFEE that have been removed from service since they were originally installed, divided between the pre-1985 OFEE that were removed before 2002, and those that were removed in 2002 or later (i.e., since the start of the PCBs TMDL). Across the three systems, nearly 1 million kilograms of oil in pre-1985 OFEE have been removed from active service due to ongoing equipment removal and maintenance programs. This represents approximately 67% of the oil from all pre-1985 OFEE in these inventories.

Both CPAU and Island Energy have already removed the bulk of their pre-1985 OFEE from active service (94% and 88%, respectively). When the pre-1985 OFEE in the historic inventory on Mare Island were factored into the calculation, the removal rate on Mare Island increased to over 99% removal of all pre-1985 OFEE. SVP has removed at least 23% of their documented pre-1985 OFEE from active service. Additional removals from the SVP system may have occurred that cannot be verified at this time (see Section 4.1.2 on SVP OFEE identified as "unknown status and age").

In addition, since the start of the PCBs TMDL in 2002, more than 320,000 kg of oil in pre-1985 OFEE have been removed from service across all three systems (Table G-2). This represents an overall 39% removal rate, and an average removal rate of 2.3% per year. The overall removal rates for each individual system over this same time period were 81% (CPAU), 68% (Island Energy) and 23% (SVP). These overall removal rates equate to average removals of 4.8% (CPAU), 4.0% (Island Energy), and 1.3% (SVP) per year. Based on these annual average removal rates, the project estimates it will take between 21 and 75 years for all pre-1985 OFEE to be removed from these systems due to continued equipment maintenance and removal programs.

Table G-2: Mass of dielectric oil in oil-filled electrical equipment (OFEE) that have been removed from active service in three municipally-owned electrical utility systems.

Utility System	Equipment Type or	Pre-1985 OFEE Oil in Inactive/Removed OFEE (kg)			Pre-1985 OFEE Removed Between 2002 and 2019		Pre-1985 OFEE removed since installation	Estimated time to remove all pre-1985 OFEE (years)
		Removed prior to 2002	Removed in 2002 or Later	TOTAL REMOVED	Overall Removal Rate	Annual Average Removal Rate		
City of Palo Alto Utilities	Padmount Single Phase Transformer	2,998	3,475	6,473	**81%**	**4.8%**	**94%**	**21**
	Padmount Three Phase Transformer	98,953	79,431	178,384				
	Poletop Transformer	204,165	47,100	251,265				
	Regulator	0	0	0				
	Underground Commercial Dist.Transformer	39,162	19,879	59,041				
	Underground Residential Dist. Transformer	54,374	17,971	72,345				
	Padmount Oil Switch	0	0	0				
	Padmount Vacuum Switch	0	0	0				
	Vault/Box Oil Switch	0	0	0				
	Vault/Box Vacuum Switches	0	0	0				
	Subtotal - CPAU	**399,651**	**167,856**	**567,508**				
Silicon Valley Power - City of	Padmount Single Phase Transformer	0	1,635	1,635	**23%**	**1.3%**	**23%**	**75**
	Padmount Three Phase Transformer	944	108,642	109,585				
	Poletop Transformer	327	21,801	22,128				
	Underground Residential Dist. Transformer	0	664	664				

Utility System	Equipment Type or	Pre-1985 OFEE Oil in Inactive/Removed OFEE (kg)			Pre-1985 OFEE Removed Between 2002 and 2019		Pre-1985 OFEE removed since installation	Estimated time to remove all pre-1985 OFEE (years)
		Removed prior to 2002	Removed in 2002 or Later	TOTAL REMOVED	Overall Removal Rate	Annual Average Removal Rate		
Santa Clara[1]	Padmount Oil Switch	0	0	0				
	Padmount Vacuum Switch	0	0	0				
	Padmount Vacuum-Disconnect Switch	0	0	0				
	Padmount Substation Transformer	0	0	0				
	Subtotal - SVP	**1,271**	**132,742**	**134,013**				
Island Energy[2]	**Current Inventory**	**5,276**	**21,161**	**26,437**	**68%**	**4.0%**	**88%**	**25**
	Historic Inventory	**266,192**	**NA[3]**	**266,192**	**NA[3]**		**100%**	
TOTALS (All Systems Combined)		**672,391**	**321,759**	**994,150**	**39%**	**2.3%**	**67%**	**43**

[1]SVP identified incomplete records for OFEE that contain approximately 566,000 kg or oil. The current status of these OFEE (active or removed) and the installation dates were unavailable at the time of this report. Therefore, these OFEE were not included in any of the totals above.

[2]Since 1997, Pittsburg Power Company has been operating the electrical distribution system on Mare Island in the City of Vallejo under the name Island Energy.

[3]NA=not applicable; the historic inventory only covers the period up to 1996.

G.2.3.4 Sensitivity Analysis – SVP Data

About 12% of the equipment in the SVP inventory did not have information on the status (active or inactive) or age (pre- or post-1985) of the OFEE. In order to evaluate the potential impact of excluding these unknown data, additional analyses were conducted to account for the following three scenarios:

1. All "unknown" OFEE are assumed to be active, pre-1985 OFEE;
2. All "unknown" OFEE are assumed to be pre-1985 OFEE that were removed from service after the start of the PCBs TMDL in 2002;
3. All "unknown" OFEE are assumed to be pre-1985 OFEE that were removed from service prior to 2002.

The results of the sensitivity analysis conducted under each of these three scenarios are shown in Table G-3. The default scenario excluded all "unknown" oil from all calculations. For each alternative scenario, the mass of "unknown" oil was added to the value for the cell highlighted in blue in the table. The minimum and maximum values calculated for each of the percentage columns are bolded in the table.

This analysis indicates that under Scenario 1, the percent of active OFEE that are pre-1985 increases from 12% to 24%, and the percent of pre-1985 OFEE that have been removed since installation decrease from 23% to 12%.

Under Scenarios 2 and 3, the percent of active pre-1985 OFEE remain the same, but the percent of pre-1985 OFEE that have been removed since installation increases from 23% to 61%, which is more in line with the rates observed for the other two systems. Scenario 3 also increases the annual average removal rate since the start of the TMDL from 1.3% to 3.6% per year.

The primary impacts of these alternative scenarios include the following:

- Under Scenario 1, the pre-1985 OFEE currently in the system more than doubled, which would result in an increase in the current PCBs loads to stormwater from this source;
- Under Scenario 3, the mass of pre-1985 OFEE removed since the start of the TMDL was nearly tripled, which would result in an increase in the PCBs stormwater loads reduced during this time period accordingly. Also under Scenario 3, because of the increased annual removal rate, all pre-1985 OFEE would be removed within 28 years (compared to 75 years in the default scenario).

Because these impacts are potentially large, the results for SVP presented in the next section used the ranges presented in Table G-3 for Scenario 1 and Scenario 2. The results for these two scenarios provide the upper and lower limits for all values across the default and alternative scenarios.

Table G-3: Sensitivity analysis conducted to evaluate the impacts of unknown status and age of oil-filled electrical equipment (OFEE) identified in the Silicon Valley Power (SVP) OFEE inventory on the evaluation of pre-1985 as a source of PCBs to urban stormwater.

Scenario	Oil in Active OFEE (kg)		Oil in Inactive/Removed OFEE (kg)			Oil in OFEE with Unknown Status and Age (kg)	Total Oil in OFEE Inventory (kg)	Percent of all Active OFEE that are Pre-1985	Percent of Pre-1985 OFEE Removed Since Installation	Pre-1985 OFEE Removed Between 2002 and 2019	
	Post-1985 OFEE	Pre-1985 OFEE	Pre-1985 OFEE removed before 2002	Pre-1985 OFEE removed in 2002 or later	Post-1985 OFEE					Overall Removal Rate	Annual Average Removal Rate
Default: "Unknown" not included in calculations	3,186,330	454,439	1,271	132,742	221,460	566,026	4,562,268	**12%**	23%	23%	1.3%
1. All "unknown" = Active, Pre-1985 OFEE	3,186,330	1,020,465	1,271	132,742	221,460		4,562,268	**24%**	**12%**	**12%**	**0.7%**
2. All "unknown" = Pre-1985 OFEE Removed in 2002 or Later	3,186,330	454,439	1,271	698,768	221,460		4,562,268	12%	**61%**	**61%**	**3.6%**
3. All "unknown" = Pre-1985 OFEE Removed Prior to 2002	3,186,330	454,439	567,296	132,742	221,460		4,562,268	12%	61%	23%	1.3%

G.2.4 Potential PCBs Mass in Active OFEE and Estimated Stormwater Loads

Table G-4 provides the calculated PCBs mass in the Island Energy historic and current OFEE inventories and estimates of the potential PCBs mass in the CPAU and SVP OFEE inventories. Only Island Energy provided data on measured PCBs concentrations in their OFEE oil. Concentrations of PCBs in Island Energy's current inventory of OFEE ranged from 1 to 37 ppm. Concentrations in the historic inventory ranged from <1 up to nearly 900 ppm. About 20% of the OFEE in the historic inventory had PCBs concentrations > 500 ppm. Based on these measured PCBs concentrations and the volumes of oil in each piece of equipment, the historic inventory documents OFEE containing more than 70 kg of PCBs. By comparison, Island Energy's current inventory of both active and inactive OFEE had 0.088 kg of PCBs. Of that total, 0.040 kg of PCBs remain in active OFEE, and 0.048 kg of PCBs were from OFEE that have been removed from active service. This represents a three-order of magnitude decrease in PCBs mass from the historic inventory. One interesting detail about the PCBs concentration data was that nearly one-third of the PCBs in the current inventory were contained in post-1985 equipment. All of these equipment were from 1986 or 1987. PCBs concentrations were generally low in these OFEE, ranging from 1 to 4 ppm. However, the potential contribution from these OFEE could still be important. For example, in the Island Energy current inventory, there is one piece of equipment from 1987 that contains 600 gallons of oil at 1 ppm PCBs, or 2 g of PCBs in total. If this quantity of PCBs were released to the environment, this could have a detrimental impact on stormwater quality.

Because CPAU and SVP did not provide measured PCBs concentrations for OFEE in their inventories, the potential PCBs mass in pre-1985 OFEE was estimated based on the assumptions described previously. For CPAU, these estimates suggest active pre-1985 OFEE may contain between 1.7 and 17 kg of PCBs, while pre-1985 OFEE that have been removed potentially contained between 28 kg and 284 kg. These estimates suggest an order of magnitude reduction in PCBs mass in the active OFEE inventory. For SVP, active pre-1985 OFEE may contain between 23 kg and 227 kg. If the "unknown" OFEE were assumed to be active pre-1985 OFEE, then the total estimated mass of PCBs in active OFEE doubles to 51 kg to 510 kg. PCBs in pre-1985 OFEE that have been removed were estimated to range from 6.7 to 67 kg, which would increase up to 35 kg to 350 kg if the "unknown" OFEE were assumed to be pre-1985 OFEE that have been removed from service. Across all three systems, the total potential mass of PCBs in active OFEE ranged from 24 kg up to 527 kg. The upper value assumes the "unknown" mass is contained within active, pre-1985 OFEE.

Table G-4: Estimated potential mass of PCBs in municipally-owned electrical utilities oil-filled electrical equipment (OFEE) inventories

OFEE Category	PCBs (kg)				
	CPAU	SVP	Island Energy - Current	Island Energy - Historic	TOTAL (All Systems)
All Active	1.7 - 17	23 - 227	0.040		24 - 244
All Removed	28 - 284	6.7 - 67	0.048	70	105 - 421
Removed since 2002	8.4 - 84	6.6 - 66	0.048		15 - 150
Removed prior to 2002	20 - 200	0.1 - 0.6		70	90 - 271
Unknown		28 - 283			28 - 283

Based on the approximate population of the MRP area of ~6 million people, if the active OFEE in all the participating municipally-owned electrical utility systems were representative of the PCBs contained in OFEE across the larger MRP area (i.e., 24 to 527 kg), the estimated mass of PCBs would range from roughly 730 kg up to 16,000 kg of PCBs. Based on acres, the estimated mass of PCBs across the larger MRP area of nearly 3 million acres would range from 2,400 kg up to 53,000 kg of PCBs in active OFEE.

Table G-5 presents the estimated loads of PCBs to stormwater from active OFEE in the three participating municipally-owned electrical utility systems. Across all three systems, the estimated PCBs stormwater load in 2002 from active OFEE was between 197 mg/yr to 3,390 mg/yr. The low end of this range is the sum of the minimum values for all active OFEE and all OFEE removed since 2002. The upper end of this range is the sum of the maximum values for all active OFEE, all OFEE removed since 2002, and all unknown OFEE. In 2020, the total estimated PCBs stormwater loads from active OFEE were estimated to range from 122 mg/yr up to 2,640 mg/yr. The low end of this range is the sum of the minimum value for all active OFEE. The upper end of this range is the sum of the maximum values for all active OFEE and all unknown OFEE. Scaling these estimates up to the MRP area of roughly 3 million acres gives a stormwater load of between 20,000 mg/yr up to 340,000 mg/yr in 2002, and 12,000 mg/yr up to 260,000 mg/yr in 2020. These estimates are highly uncertain due to all the assumptions that were used in the calculations.

Table G-5: Estimated range of PCBs loads to stormwater from oil-filled electrical equipment within three municipally-owned electrical utility systems.

OFEE Category	PCBs Stormwater Loads (mg/yr)				
	CPAU	SVP	Island Energy - Current	Island Energy - Historic	TOTAL
All Active OFEE	8.3 - 84	114 - 1,136	0.199	0	122 - 1,220
All Active OFEE - assume "unknown" = active	8.3 - 84	255 - 2,551	0.199	0	264 - 2,636
All Removed OFEE	142 - 1,419	34 - 335	0.241	352	527 - 2,106
Removed since 2002	42 - 420	33 - 332	0.241	0	75 - 752
Removed prior to 2002	100 - 999	0.3 - 3.2		352	452 - 1,354
All Removed OFEE - assume "unknown" = removed	142 - 1,419	175 - 1,750	0.241	352	317 - 3,169
Unknown		142 - 1,415			142 - 1,415

G.3 DATA INPUTS NEEDED TO CALCULATE PCBS LOADS REDUCED FOR THE PCBS IN ELECTRICAL UTILITIES MANAGEMENT PROGRAM

The proposed new Electrical Utilities Management Program identifies actions to document PCBs load reductions that have occurred since the start of the TMDL and will continue to occur in the future due to removal of PCBs-containing OFEE, until all of these equipment have been removed from active service in electrical utility systems in the Bay Area. The data inputs needed to calculate the loads reduced due to ongoing removal of PCBs-containing equipment as described in Section 5.0 of the BASMAA SCLRA report (BASMAA 2021) include the following terms:

Term 1 (L_0) = Initial annual load of PCBs that enters MS4 from OFEE at the start of the PCBs TMDL (approximately 2005), kg/yr).

Term 2 (F) = Estimated fraction of PCBs loads prevented from entering the MS4 each year due to OFEE removal (dimensionless fraction).

Based on the analysis presented in this appendix, and described in greater detail in BASMAA 2020, the values that are recommended for each of these terms are presented in Table G-6.

Table G-6: Recommended values for each of the terms required to account for the PCBs load reductions achieved through the PCBs in Electrical Utilities Management Program.

Term	Description	Value	Units	Source
1	Annual PCBs Stormwater Load in 2005 (i.e., the assumed load at the start of the PCBs TMDL)	1.1	kg/yr	McKee et. al. (2006)
2	Fraction of PCBs loads prevented from entering MS4 due to equipment removals.	0.013 to 0.048 (average = 0.023)	dimensionless fraction	BASMAA 2020

G.3.1 Term 1: Initial Load of PCBs to MS4 from OFEE at the Start of the PCBs TMDL

For Term 1 the estimated PCBs load of 1.1 kg/yr in 2005 is the recommended starting value for the annual load of PCBs to stormwater at the start of the PCBs TMDL. This value is currently the best available estimate of PCBs loads to the Bay from electrical utility equipment at that time.

This value was derived from the McKee et al. (2006) PCBs mass balance model that estimated the total loads to stormwater from all major sources during the peak period of PCBs production and use (i.e., 1950 – 1990), and in the period of the study (i.e., 2005). The mass balance model started with the total mass of PCBs that was used in the region between 1950 and 1990 and apportioned that mass to the major source categories. The largest PCBs-use category was transformers and large capacitors (i.e., oil-filled electrical equipment, OFEE). The total mass used in transformers and large capacitors between 1950 and 1990 was estimated at 7,600 metric tons (MT). Although most of this PCBs mass remains contained within the equipment, a small percentage of PCBs are released each year due to spills and leaks. These releases are the primary source of PCBs to stormwater conveyances from OFEE. Using literature values and the assumptions outlined below, McKee et al. (2006) estimated the following:

- Between 1950 and 1990 (the peak period of production and use of PCBs in the U.S.) 120 – 520 kg of PCBs entered stormwater conveyances due to releases from transformers and large capacitors. On average, this equated to a stormwater load of 8 kg/yr to the San Francisco Bay from electrical utility equipment during that time period.
- In 2005, the mass of PCBs entering stormwater conveyances due to releases from transformers and large capacitors was 1.2 to 4.3 kg/year (average = 2.8 kg/yr). The assumptions and literature data that were used to calculate the 2005 load included the following:
    - 0.05% was estimated to leak from transformers and 0.35% from large capacitors each year over an assumed 30-year service life (Harrad 1994, EIP Associates 1997).

- When spills occur, 99% of the spilled PCBs are cleaned up and only 1% of the remaining PCBs are left on erodible surfaces and available for wash off;
- Assumed runoff coefficients based on land-use classifications were used to approximate the fraction of PCBs on erodible surfaces that can enter local storm drains each year; and
- A small fraction (0.3%) of PCBs released to the environment enter the atmosphere (Keeler et al. 1993); McKee et al. (2006) estimated 2% to 6% of these PCBs are subsequently captured in stormwater through wet deposition.

McKee et al. (2006) estimated a stormwater load of 2.8 kg/yr to the Bay from transformers and large capacitors in 2005. This value (2.8 kg/yr) is the starting point for estimating load reductions that have been achieved since the PCBs TMDL was established. As shown in Table G-7, the McKee et al. (2006) mass balance model presents the best estimate for the total PCBs stormwater load from all sources in 2005 as 52 kg/yr. The PCBs TMDL for the San Francisco Bay identifies the total stormwater load at that time as 20 kg/yr (SFBRWQCB 2008). For consistency with the TMDL, the McKee et al. (2006) best estimate for stormwater loads from various sources were normalized to a total stormwater load of 20 kg/yr (Table G-7). As shown in Table G-7, the TMDL-normalized PCBs load to stormwater conveyances in 2005 from electrical utility equipment is assumed to be 1.1 kg/yr. This value is one to two orders of magnitude larger than the estimated stormwater loads that were developed in this project based on extrapolation of the municipally-owned electrical utility data presented in Section 4.0 to the larger Bay Area (0.02 – 0.34 kg/yr). However, the stormwater load estimates extrapolated from the participating municipally-owned electrical utility data have some important limitations. There is currently no information available to determine if these estimates, representative of electrical utilities operating across small service areas, would be appropriate as representative of the OFEE and associated PCBs mass across the much larger MRP area. These utility systems service a population of less than 200,000 people, again a tiny fraction (about 3%) of the larger MRP area population of nearly 6 million people. These utility systems also serve an area of less than 30,000 acres, which is (1%) of the entire MRP area of nearly 3 million acres. Almost all of the remaining area is served by PG&E, a large private company that may not be well-represented by data from the three small municipally-owned electrical utilities that participated in this project. There are likely substantial differences between PG&E equipment, operations, and practices, especially in the past, that preclude extrapolating the municipally-owned utility data from this project to PG&E service areas across the Bay Area. The number, type and range of transmission and distribution OFEE that make up a small service area system may not be representative or scalable to the number, type and range of transmission and distribution OFEE that make up a large service area system where electricity must be delivered over larger distances.

There was also considerable variability in the quality and quantity of the OFEE inventory data provided across the three participating municipally-owned utility systems that was used to develop the load estimates from municipally-owned electrical utility data. Island Energy provided complete information on their current inventory but acknowledged there were gaps in the historic data and they could not verify the accuracy or completeness of those data. Neither CPAU nor SVP had information on measured PCBs concentrations in any of their OFEE. SVP, the largest among the three participating utilities, had large uncertainty in their data because of the “unknown” OFEE category. SVP indicated it may be possible in the future to resolve some of these uncertainties. However, within the time frame of this project, SVP provided the data they were able to access. One of the limitations was that compiling these data, especially during the COVID-19 pandemic and shelter-in-place orders, was extremely challenging for the utility staff. This was especially true for data that were limited to hard copies or available only on computer servers located at the electrical utility offices. Under these conditions, SVP was still able to provide useful data on a large portion of their OFEE inventory.

Given the limitations described here, the use of the municipally-owned electrical utility OFEE inventory data to represent OFEE beyond the boundaries of each of the participating systems may not be appropriate. The McKee et al. (2006) TMDL-normalized stormwater load estimate of 1.1 kg/yr remains the best currently available estimate of the PCBs load from electrical utility equipment to the Bay at the start of the PCBs TMDL.

Table G-7: PCBs mass input to stormwater conveyances in the San Francisco Bay Area from all sources based on the mass balance model presented in McKee et al. (2006). Transformers and Large Capacitors represent the oil-filled electrical utility equipment source.

Source	McKee et al., (2006) PCBs Load (kg/yr)	PCBs Load Normalized to TMDL Stormwater Load (kg/yr)
Watershed Surface Sediment Erosion	30	12
Building Demolition and Remodeling	4.1	1.6
PCBs Still in Use	4	1.5
Bed and Bank Erosion	2.9	1.1
Transformers and Large Capacitors	**2.8**	**1.1**
Atmospheric Deposition	2.8	1.1
Identified Industrial Contaminated Areas	2	0.77
Plasticizers	1.1	0.43
Railway Lines	1.1	0.43
Small Capacitors	0.5	0.19
Auto-Recycling	0.4	0.15
Other Dissipative Uses	0.06	0.023
Lubricants	0	0
Landfills	0	0
Total Stormwater Load (kg/yr)	**52**	**20**

G.3.2 Term 2 –Fraction of PCBs Loads Prevented from Entering MS4 Annually

For Term 2, the recommended value for the annual fraction of PCBs prevented from entering the MS4 due to OFEE removal ranges from 0.013 to 0.048 per year, with an average value of 0.023 per year (Table G-6). These values are based on the annual average equipment removal rates that were calculated for Bay Area municipally-owned electrical utilities of 1.3% to 4.8% annually, as described above and in full detail in BASMAA, 2020.

These values were calculated based on the mass of oil in pre-1985 OFEE that was removed from service between 2002 and 2019. Use of these values for Term 2 assumes the rate of load reduction achieved over the time period of interest is approximately equivalent to the equipment removal rate achieved during that same time period. Further, these values also assume the equipment removal rates for the municipally-owned electrical utilities reasonably represent the equipment removal rates at other Bay Area electrical utilities (i.e., PG&E). As a check on these assumptions, the load reduction rate between 1990 and 2005 based on the estimate in the McKee et al (2006) mass balance models was compared with the equipment removal rates calculated for municipally-owned electrical utilities. The McKee et al. (2006) mass balance models provide PCBs stormwater load estimates for electrical utilities in 2005, and during the peak period of PCBs production and use (1950 – 1990). Based on these estimates, the PCBs load to stormwater from OFEE in 2005 was 65% lower than the average annual load in1990. That equates to a PCBs load reduction of 4.33% per year during the fifteen-year period between 1990 and 2005. This annual average PCBs load reduction rate compares well with the equipment removal rates calculated for Bay Area municipally-owned electrical utilities. This finding supports the assumption that most of this load reduction was likely the result of the removal and proper disposal of PCBs-containing OFEE. During the late 1980s and 1990s, electrical utilities implemented voluntary equipment replacement programs specifically designed to remove PCBs-containing OFEE. Past statements provided to the Regional Water Board by PG&E support the assertion that the majority of PCBs-filled equipment had been replaced by the early 2000's (PG&E 2000). Additional removals have continued to occur, albeit at a slower pace, due to routine maintenance programs that replace older electrical equipment that is more likely to contain PCBs with newer equipment that does not contain PCBs. Information provided to the Regional Water Board by PG&E on maintenance records from their Emeryville processing facility supports this assertion (PG&E 2000). Those data indicate that in 1999, approximately 10% of the 22,000 pieces of OFEE that were dismantled and disposed of at the Emeryville site had PCBs at concentrations at or above 50 ppm. This information further supports the assertion that a large mass of PCBs that were in use during the peak period have since been removed. However, this information also indicates there are still large numbers of equipment that contain PCBs at high concentrations in active service across the Bay Area. Although no information was provided on the percent of equipment that contained PCBs at lower concentrations (i.e., below 50 ppm), equipment with these lower concentrations are also potential sources to stormwater. As reported in BASMAA 2020, current spill reports in Cal OES records (Cal OES 2017) further corroborate that PCBs-containing equipment are still in use across the Bay Area, both at concentrations above and below 50 ppm.

G.4 REFERENCES

Bay Area Stormwater Management Agencies Association (BASMAA) 2020. PCBs from Electrical Utilities in San Francisco Bay Area Watersheds Stressor/Source Identification (SSID) Project. Prepared by EOA, Inc. June 30, 2020.

California Office of Emergency Services (Cal OES) 2017. Hazardous Materials Spill Release Reporting Archive 1993-2017 review. Governor's Office of Emergency Services, Sacramento, CA. http://www.caloes.ca.gov/cal-oes-divisions/fire-rescue/hazardous-materials/spill-release-reporting.

EIP Associates 1997. Polychlorinated biphenyls (PCBs) source identification. A report prepared for Palo Alto Regional Water Quality Control Plant, Palo Alto, CA. October 1997.

Harrad, S.J, Sewart, A.P., Alcock, R., Boumphrey, R., Burnett, V., Durarte-Davidson, R., Halsall, C., Sanders, G., Waterhouse, K. Wild, S. R., and Jones, K.C., 1994. Polychlorinated biphenyls (PCBs) in the British environment: sinks, sources, and temporal trends. 131 pp.

Keeler G.J., Pacyna J.M. Bidleman T.F., Nriagu J.O., 1993. Identification of Sources Contributing to the Contamination of the Great Waters (Revised) EPA/453/R-94/087. Washington, DC: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards.

McKee, L., Mangarella, P., Williamson, B., Hayworth, J., and Austin, L., 2006. Review of methods used to reduce urban stormwater loads: Task 3.4. A Technical Report of the Regional Watershed Program: SFEI Contribution #429. San Francisco Estuary Institute, Oakland, CA.

Pacific Gas & Electric Company (PG&E) 2000. Correspondence from Robert Doss, PG&E's Environmental Support and Service Principal in response to San Francisco Regional Water Quality Control Board information request on historic and current PCB use. Pacific Gas and Electric Company, San Francisco, CA. September 1, 2000.

San Francisco Regional Water Quality Control Board (SFRWQCB) 2008. Total Maximum Daily Load for PCBs in San Francisco Bay. Final Staff Report for Proposed Basin Plan Amendment. February 13, 2008.

Sanchez, Daniel 2016. Manager of HazMat and Water Quality Environmental Management Programs, Pacific Gas & Electric Company (PG&E). *Personal communication*. February 25, 2016.

Attachment 12.1

PCBs in Building Materials Management Program Fiscal Year 2021/22 Data Summary

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Memorandum

Date:	August 31, 2022
To:	Karin Graves, Contra Costa Clean Water Program
From:	Lisa Austin, Senior Principal, Lisa Welsh, Project Scientist, and Grace Yao, Staff Engineer
Subject:	PCBs in Building Materials Management Program – Fiscal Year 2021/22 Data Summary Geosyntec Project Number: CWR0758

1. BACKGROUND

Municipal Regional Stormwater Permit (MRP; Order No. R2-2015-0049) Provision C.12.f requires Permittees to manage polychlorinated biphenyls (PCBs) containing materials and wastes during building demolition activities. The MRP Permittees have developed and implemented a process, beginning in July 2019, for managing materials with PCBs concentrations of 50 ppm or greater in applicable structures when applicable structures undergo demolition. Applicable structures include commercial, public, institutional, and industrial buildings constructed or remodeled between 1950 and 1980 undergoing full-building demolition. Single-family residential and wood frame structures are exempt.

This technical memorandum documents the following items for the Contra Costa County Permittees, as required by MRP Provision C.12.f.iii.(4):

a. The number of applicable structures that applied for a demolition permit during the reporting year; and

b. A running list of the applicable structures that applied for a demolition permit (since the date the PCBs control protocol was implemented) that had material(s) with PCBs at 50 ppm or greater, with the address, demolition date, and a brief description of the PCBs control method(s) used.

2. NUMBER OF APPLICABLE STRUCTURE APPLICATIONS

Table 1 below lists the number of applicable structures that applied for a demolition permit within Contra Costa County during Fiscal Year 2021/22 (i.e., from July 1, 2021 – June 30, 2022) and the number of samples in those buildings that were equal to or greater than 50 ppm.

Table 1: Number of Applicable Structures that Applied for a Demolition Permit in FY 2021/22

Permittee	# Applicable Structures	# Applicable Structures With At Least One Sample ≥ 50 ppm PCBs	# Samples ≥ 50 ppm PCBs
Clayton	0	0	0
Concord	0	0	0
Danville	0	0	0
El Cerrito	0	0	0
Hercules	0	0	0
Lafayette	0	0	0
Martinez	0	0	0
Moraga	0	0	0
Orinda	0	0	0
Pinole	0	0	0
Pittsburg	12	0	0
Pleasant Hill	0	0	0
Richmond	3	2	2
San Pablo	0	0	0
San Ramon	0	0	0
Contra Costa County	3	1	37
Walnut Creek	0	0	0
Contra Costa County Total	**18**	**3**	**39**

3. LIST OF APPLICABLE STRUCTURES

A list of the applicable structures that applied for a demolition permit since July 1, 2019, that had materials with PCBs at 50 ppm or greater, with the address and estimated demolition date, is provided in Attachment 1.

4. DESCRIPTION OF PCBS CONTROL METHOD

4.1 Permittee Control Method

On behalf of the MRP Permittees, the Bay Area Stormwater Management Agencies Association (BASMAA) conducted a regional project that developed an implementation framework, guidance materials, and tools for local agencies to ensure PCBs-containing materials and wastes are appropriately managed during building demolition. The Regional Project also provided training materials and a workshop for municipal staff, and an outreach workshop for the industry on implementing the framework/protocols developed via the project.

Permittees have implemented the following process for this control measure:

- The municipality informs applicable demolition permit applicants that their projects are subject to the program for managing materials with PCBs, necessitating, at a minimum, an initial screening for priority PCBs–containing materials.
- For every applicable demolition project, applicants implement the BASMAA protocol for identifying building materials with PCBs concentrations of 50 ppm or greater and then complete and submit a version of BASMAA's model "PCBs Screening Assessment Form" (Screening Form) or equivalent to the municipality.
- The municipality reviews the Screening Form to make sure it is filled out correctly and is complete and works with the applicant to correct any deficiencies.
- The municipality then issues the demolition permit or equivalent, according to its procedures.
- The municipality sends each completed Screening Form for applicable structures and any supporting documents to its countywide program. The countywide program compiles the forms and works with the other MRP countywide programs to manage and evaluate the data and assist Permittees with associated MRP reporting requirements.

4.2 Building Demolition Applicant Control Method

Applicants that determine that PCBs exist in priority building materials must follow applicable federal and state laws for handling and disposal, such as reporting to the U.S. Environmental Protection Agency (USEPA), the San Francisco Bay Regional Water Quality Control Board, and the California Department of Toxic Substances Control (DTSC). These agencies may require additional sampling and abatement of PCBs.

The Toxic Substances Control Act (TSCA) regulates the disposal of PCBs waste. Depending on the approach for sampling and removing building materials containing PCBs, the applicant may need to notify or seek advance approval from USEPA before building demolition. For example, TSCA requires manifesting the waste for transportation and disposal. (See 40 Code of Federal Regulations (CFR) 761 and 40 CFR 761, Subpart K.) Regulation under TSCA is not limited to materials containing PCBs at or above 50 ppm. There are circumstances in which materials containing PCBs below 50 ppm are subject to regulation under TSCA. (See 40 CFR 761.61(a)(5)(i)(B)(2)(ii).). 40 CFR 761.3 provides information relative to the disposal of PCBs-containing building materials, including definitions of PCBs bulk product wastes and PCBs remediation wastes. The memorandum "PCB Bulk Product Waste Reinterpretation" from the Office of Resource Conservation and Recovery, EPA,[1] provides more information.

Additionally, the disposal of PCBs waste is subject to California Code of Regulations (CCR) California Code of Regulations (CCR) Title 22, Section Division 4.5, Chapter 12, Standards Applicable to Hazardous Waste Generators.

*****

[1] Located here: https://www.epa.gov/sites/production/files/2016-01/documents/wste-memo_102412.pdf.

Attachment 1
List of Applicable Structure Applications for Contra Costa County Permittees with PCBs at 50 ppm or Greater

CCCWP PCBs in Building Materials Management Program – Data Summary (2019 – 2022)

Permittee	Building ID	Address	Estimated Demo Date	# Samples ≥ 50 ppm PCBs	PCBs Concentration Range (mg/kg)
Concord	CCC-01	2292 Concord Blvd, Concord, CA, 94520	May 2020	6	140-550
Unincorporated County	102	1750 Oak Park Blvd, Pleasant Hill, CA, 94523	September 2020	12	54-130,000
Unincorporated County	CC-1	651 Pine Street, Martinez, CA 94553	June 2022	37	ND-75,000
Richmond	Shipping/Receiving Building	731 W. Cutting Blvd, Richmond 94804	March 2022	1	1.9-540
Richmond	Helium Building	731 W. Cutting Blvd, Richmond 94804	March 2022	1	0.82-82

Attachment 12.2

Fish Risk Reduction Program for Mercury and PCBs 2022 Status Report

Contra Costa Clean Water Program

Fish Risk Reduction Program for Mercury and PCBs:

2022 Status Report

Submitted to the San Francisco Bay Regional Water Quality Control Board

In Compliance with NPDES Permit Provision C.11.e & C.12.h Municipal Regional Stormwater Permit (Order No. R2-2015-0049)

August 2022

CONTRA COSTA CLEAN WATER PROGRAM

255 Glacier Drive • Martinez, California 94553
Tel (925) 313-2360 • Fax (925) 313-2301
www.cccleanwater.org

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Contra Costa Clean Water Program

Fish Risk Reduction Program for Mercury and PCBs: 2022 Status Report

August 2022

Submitted to

San Francisco Bay Regional Water Quality Control Board
In Compliance with NPDES Permit Provision C.11.e & C.12.h
Municipal Regional Stormwater Permit (Order No. R2-2015-0049)

Prepared for

Contra Costa Clean Water Program
255 Glacier Drive
Martinez, California 94553

Contra Costa Clean Water Program Participants

- Cities of: Antioch, Brentwood, Clayton, Concord, Danville (Town), El Cerrito, Hercules, Lafayette, Martinez, Moraga (Town), Oakley, Orinda, Pinole, Pittsburg, Pleasant Hill, Richmond, San Pablo, San Ramon, and Walnut Creek
- Contra Costa County
- Contra Costa County Flood Control & Water Conservation District

Prepared by

Kinnetic Environmental, Inc.
9057C Soquel Drive, Suite B
Aptos, California 95003

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ACRONYMS AND ABBREVIATIONS

Bay Area	San Francisco Bay Area
CCCWP	Contra Costa Clean Water Program
CDFW	California Department of Fish and Wildlife
CVRWQCB	Central Valley Regional Water Quality Control Board
Delta	Sacramento-San Joaquin River Delta
FY	Fiscal Year
MRP	Municipal Regional Stormwater Permit
NPDES	National Pollutant Discharge Elimination System
OEHHA	California Office of Environmental Health Hazard Assessment
PCBs	polychlorinated biphenyls
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board

1 INTRODUCTION

The Municipal Regional Stormwater National Pollutant Discharge Elimination System (NPDES) Permit (MRP) (SFBRWQCB, 2015) requires Permittees to conduct an ongoing risk reduction program to address public health impacts of mercury and PCBs in fish within the San Francisco Bay and Sacramento-San Joaquin River Delta (Delta). In each fiscal year (July 1-June 30), the Contra Costa Clean Water Program (CCCWP), in conjunction with the California Office of Environmental Health Hazard Assessment (OEHHA), conduct and maintain a public health outreach program designed to reach a minimum of 3,000 individuals annually who are likely consumers of San Francisco Bay or Delta-caught fish.

This status report provides an overview of the Fish Risk Reduction Program and summarizes progress achieved by CCCWP during fiscal year (FY) 2021-2022. The report highlights ongoing activities, suggestions for outreach improvements, and considers options to maximize the program's effectiveness since being implemented under the MRP.

1.1 MRP Provision

Contra Costa County lies within the jurisdictions of both the San Francisco Bay (Region 2) and Central Valley (Region 5) Regional Water Quality Control Boards (SFBRWQCB and CVRWQCB, respectively). Municipal stormwater discharges in Contra Costa County are regulated by the requirements of the MRP for urban stormwater in Region 2 (Order No. R2-2019-0004). This progress report is in compliance with the reporting requirements specified in provisions C.11.e and C.12.h of the MRP, as issued by SFBRWQCB Order No. R2-2015-0049 and amended by Order No. R2-2019-0049, which incorporates the eastern portion of Contra Costa County within the requirements of the MRP.

1.2 Task Description

The Fish Risk Reduction Program was designed to raise awareness and address public health impacts from PCBs and mercury in San Francisco Bay and Central and South Sacramento-San Joaquin River Delta fish by:

- Taking action to reduce actual and potential health risks in people and communities most likely to consume San Francisco Bay/Delta-caught fish, such as subsistence fishers, recreational anglers, and their families.
- Working with local health departments, regional parks, and Permittees to coordinate resources for the program to target at-risk populations.

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2 APPROACH

The Fish Risk Reduction Program is designed to provide public awareness of the risks involved with consuming fish caught in the San Francisco Bay and Central and South Sacramento-San Joaquin River Delta Regions. In order to achieve this goal, CCCWP identified locations where individuals who catch fish are likely to frequent. The locations include local harbors and marinas (Table 1), bait, tackle, and fishing supply stores (Table 2), and fishing piers and regional park shoreline locations (Table 3). All outreach locations listed in Tables 1 and 2 are contacted twice annually to provide each location with the appropriate type and quantity of brochures or posters (Attachment 1). Brochures and posters are then kept on display at marina informational kiosks and storefront countertops.

The following locations (Tables 1 and 2) were contacted twice during FY 2021-2022, once during the fall, and again the following spring. Where applicable, CCCWP staff also conducted status checks on marina kiosks to confirm posted material at information kiosks had not been vandalized and was still currently available.

Table 1. Outreach Locations at Harbors and Marinas

Location	Address
Antioch Marina	1 Marina Plaza, Antioch
New Bridge Marina	6325 Bridgehead Road, Antioch
Piper Point Marina	3861 Willow Road, Bethel Island
Bethel Harbor	3405 Harbor Road, Bethel Island
Bethel Island Marina	6050 Bethel Island Road, Bethel Island
New Anchor Marina	1970 Taylor Road, Bethel Island
New Life Marina	1200 Taylor Road, Bethel Island
Sugar Barge Resort and Marina	1440 Sugar Barge Road, Bethel Island
Russo's Marina	3995 Willow Road, Bethel Island
Emerald Point Marina	4262 Windsweep Road, Bethel Island
Cruiser Haven Yacht Club	7000 Orwood Road, Brentwood
Holland Riverside Marina	7000 Holland Tract Road, Brentwood
Lazy M Marina	5050 Clifton Court Road #C, Discovery Bay
Discovery Bay Yacht Harbor	5901 Marina Road #1, Discovery Bay
Martinez Marina	7 North Court Street, Martinez
Big Break Marina	100 Big Break Road, Oakley
Hennis Marina	3255 Wells Road, Oakley
Pittsburg Marina	51 Marina Boulevard, Pittsburg
Marina Bay Yacht Harbor	1340 Marina Way S, Richmond
Brickyard Cove Marina	1160 Brickyard Cove Road Suite 110, Richmond
Rodeo Marina	2 Pacific Avenue, Rodeo

Table 2. Outreach Locations at Bait, Tackle, and Fishing Supply Stores

Location	Address
Gotcha Bait and Tackle	3500 E 18th Street, Antioch
Lost Anchor Bait & Tackle	1001 McAvoy Road, Bay Point
Gateway Gas and Mart	3615 Gateway Road, Bethel Island
The Bass Hole	6277 Bethel Island Road, Bethel Island
Orwood Resort and Bait Shop	4451 Orwood Road, Brentwood
Bay Tackle	5815 Cutting Boulevard, El Cerrito
Gas ‘n Save	1541 East Cypress Road, Oakley
Hook, Line & Sinker	3100 Main Street #260, Oakley
Marina Emporium	5993 Bethel Island Road, Oakley
Fisherman’s Catch	27 Marina Boulevard, Pittsburg
City Arms East	60 Golf Club Road #B, Pleasant Hill
Creative Sports	1712 Linda Drive, Pleasant Hill
Rodeo Bait & Tackle	205 Pacific Avenue, Rodeo
Rodeo Sport & Liquor	133 Parker Avenue, Rodeo

In addition to outreach locations at harbors, marinas, and local fishing supply stores, CCCWP Permittees, in coordination with Contra Costa Health Services and the East Bay Regional Parks District, collectively implemented fish risk reduction activities by posting, maintaining, and inspecting fish consumption warning signs on an annual basis at the fishing piers and regional shoreline locations listed in Table 3. During FY 2019-2020, CCCWP coordinated with OEHHA on receiving updated graphics for custom metal signs to display at San Francisco Bay and Sacramento-San Joaquin River Delta fishing piers and regional shorelines. With the updated signs, CCCWP worked with Permittees and East Bay Regional Parks District managers to install updated metal signs at fishing piers and popular fishing shorelines throughout the county. Photo documentation showing an update of sign installations during FY 2021-2022 is presented in Figures 1 through 6.

Currently, new metal signs have been installed or are in the process of being installed at 10 San Francisco Bay fishing piers/regional shorelines and five Delta fishing piers/regional shorelines (Table 3). Field staff reconnaissance of locations in Table 3 determined some locations at fishing piers or along regional shorelines contain out-of-date material. To eliminate out-of-date material, CCCWP is removing and replacing old signs no longer containing OEHHA’s official advisory, or by temporarily amending old contact information and out of date age limits with information that correctly reflects the official OEHHA advisory. Amending out-of-date material is temporary, and status checks of weatherproof labels that were placed over old information will be conducted annually until new sign installations are complete.

Table 3. Fishing Piers and Regional Shoreline Signs

Sign Location	Sign Address	Sign Status
Antioch/Oakley Regional Shoreline Fishing Pier	Bridgehead Road at Wilbur Avenue, Antioch	Install complete
Antioch Marina Fishing Pier	1 Marina Plaza, Antioch	Amendment in progress
Antioch Fishing Pier	9 I Street, Antioch	Replacement in progress
Carquinez Strait Regional Shoreline and Eckley Fishing Pier	5700 Eckley Road, Crockett	Install complete
Clifton Court Forebay	5072 Clifton Court Road, Discovery Bay	Replacement in progress
Radke Martinez Regional Shoreline and Martinez Fishing Pier	7 North Court Street, Martinez	Install complete
Pittsburg Fishing Pier	22 Cutter Avenue, Pittsburg	Amendment Complete
John J. Sheridan Fishing Pier	1499 Harbor Way South, Richmond	Replacement in progress
Big Break Regional Shoreline	69 Big Break Road, Oakley	Install complete
Point Pinole Regional Shoreline and Fishing Pier	5551 Giant Highway, Richmond	Install complete
Point Isabel Regional Shoreline	2701 Isabel Street, Richmond	Install complete (laminated poster in kiosk)
Point Molate Fishing Pier	1721 Stenmark Drive, Richmond	Install complete
Miller/Knox Regional Shoreline and Ferry Point Fishing Pier	1545 Dornan Drive, Richmond	Install complete
Lucretia Edwards Shoreline Park and Richmond Launch Ramp	1500 Marina Way South, Richmond	Install complete (laminated poster in kiosk)
San Pablo Bay Regional Shoreline at Lone Tree Point	413 San Pablo Avenue, Rodeo	Install complete

Figure 1. **New sign installation at Point Molate– overview**

Figure 2. **New sign installation at Point Molate – closeup**

Figure 3. New sign installation at Lone Tree Point – overview

Figure 4. New sign installation at Lone Tree Point – closeup

Figure 5. New sign installation at Radke Martinez Regional Shoreline Fishing Pier - overview

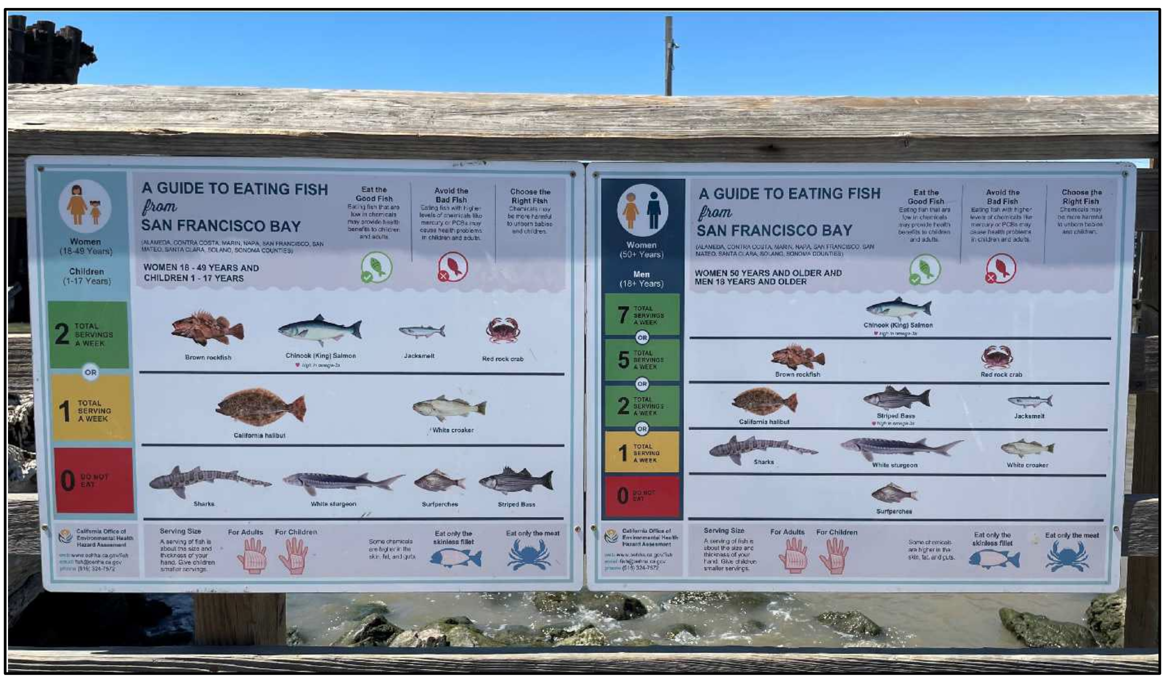

Figure 6. New sign installation at Radke Martinez Regional Shoreline Fishing Pier - closeup

3 PROGRESS TO DATE

Bait and tackle stores and local harbors and marinas were individually contacted via telephone to establish the languages which would best reach their specific clientele. Brochures, flyers, and posters were subsequently provided to each of the 21 harbors and marinas listed in Table 1, and the 14 bait, tackle and fishing supply stores listed in Table 2. Fishing piers and regional shorelines listed in Table 3 have existing metal signs or posters located in high visibility areas such as park informational kiosks. Figure 7 provides an overview map of the fish risk reduction program outreach locations.

3.1 Number of People Reached

CCCWP estimates the Fish Risk Reduction Program has the potential to reach well over the program's minimum target of 3,000 individuals annually. In FY 2021-2022, CCCWP delivered 30 to 100 brochures to each of the locations listed in Tables 1 and 2. If each location listed in Tables 1 and 2 (35 total locations) delivers just 30 brochures or flyers annually, this effort can reach over 1,000 individuals throughout the county. In FY 2021-2022, discussions with bait shop owners, harbor masters, and marina staff confirm that 30 brochures annually per location is both accurate and a conservative estimate, as the majority of locations listed in Tables 1 and 2 requested brochures to be restocked during every spring and fall outreach effort.

In addition to Tables 1 and 2, the estimate to reach 3,000 individuals annually can be achieved at the locations in Table 3 alone. If just one individual per day views the fish risk reduction signage at each of the 15 fishing piers or shoreline kiosks, multiplied by 200 views per pier annually, it is estimated that 3,000 individuals will view the signage alone. Two hundred views per pier or shoreline annually is a conservative estimate and accounts for periods of inclement weather or poor fishing conditions. In FY 2020-2021, CCCWP field staff spoke with shoreline supervisors from the East Bay Regional Parks District, who estimated hard signs each have the potential to receive as many as 100 views on a busy weekend at the more popular fishing piers. This figure supports the program's conservative estimate of 200 views per pier annually to obtain the minimum outreach goal.

3.2 Additional Measures Adopted in 2021-2022

Brochures and flyers are currently made available to bait and tackle shops in English, Spanish, Simplified Chinese, Laotian and Vietnamese. Coordination with bait and tackle shops has enabled field staff to become familiar with which regions of the county have more demand for supply of material in foreign languages. In addition to the provided languages currently established, business operators have expressed interest in providing outreach material in additional languages such as Russian and Tagalog. During FY 2021-2022, CCCWP began documenting the languages and locations business operators expressed interest in expanding the availability of outreach material to subsistence fishermen. Distribution of this material plans to begin in FY 2022-2023 at interested bait and tackle shops.

As part of the continued effort to effectively reach the maximum number of people likely to consume fish from the San Francisco Bay and Sacramento-San Joaquin River Delta, CCCWP maintains a list of locations approved by the California Department of Fish and Wildlife (CDFW) to sell recreational fishing licenses. In addition to bait, tackle, and fishing supply stores identified in Table 2, there are 17 additional locations (big box retailers) where recreational fishing supplies and licenses are available for purchase (Table 4). This list of big box retailers is kept current while CCCWP coordinates program participation with corporate offices of these retailers.

Table 4. Additional Fish License Retailers

Location	Address
Big 5 – Store #303	4859 Lone Tree Way, Antioch
Big 5 – Store #378	2689 Clayton Road, Concord
Big 5 – Store #178	11060 San Pablo Ave, El Cerrito
Big 5 – Store #062	1572 Fitzgerald Drive, Pinole
Big 5 – Store #113	4701 Century Boulevard, Pittsburg
Big 5 – Store #437	510 Contra Costa Blvd, Pleasant Hill
Big 5 – Store #071	3209 Crow Canyon Place, San Ramon
Big 5 – Store #132	1630 Mt Diablo Boulevard, Walnut Creek
CVS – Store #09511	1175 2nd Street, Brentwood
CVS – Store #09565	14830 Highway 4, Discovery Bay
Dick's Sporting Goods	2314 Monument Boulevard, Pleasant Hill
REI	1975 Diamond Blvd Ste B100, Concord
Walmart – Store #2697	4893 Lone Tree Way, Antioch
Walmart – Store #5610	9100 Alcosta Boulevard, San Ramon
Walmart – Store #1615	2203 Loveridge Road, Pittsburg
Walmart – Store #3493	1021 Arnold Drive, Martinez
Walmart – Store #3455	1400 Hilltop Mall Road, San Pablo

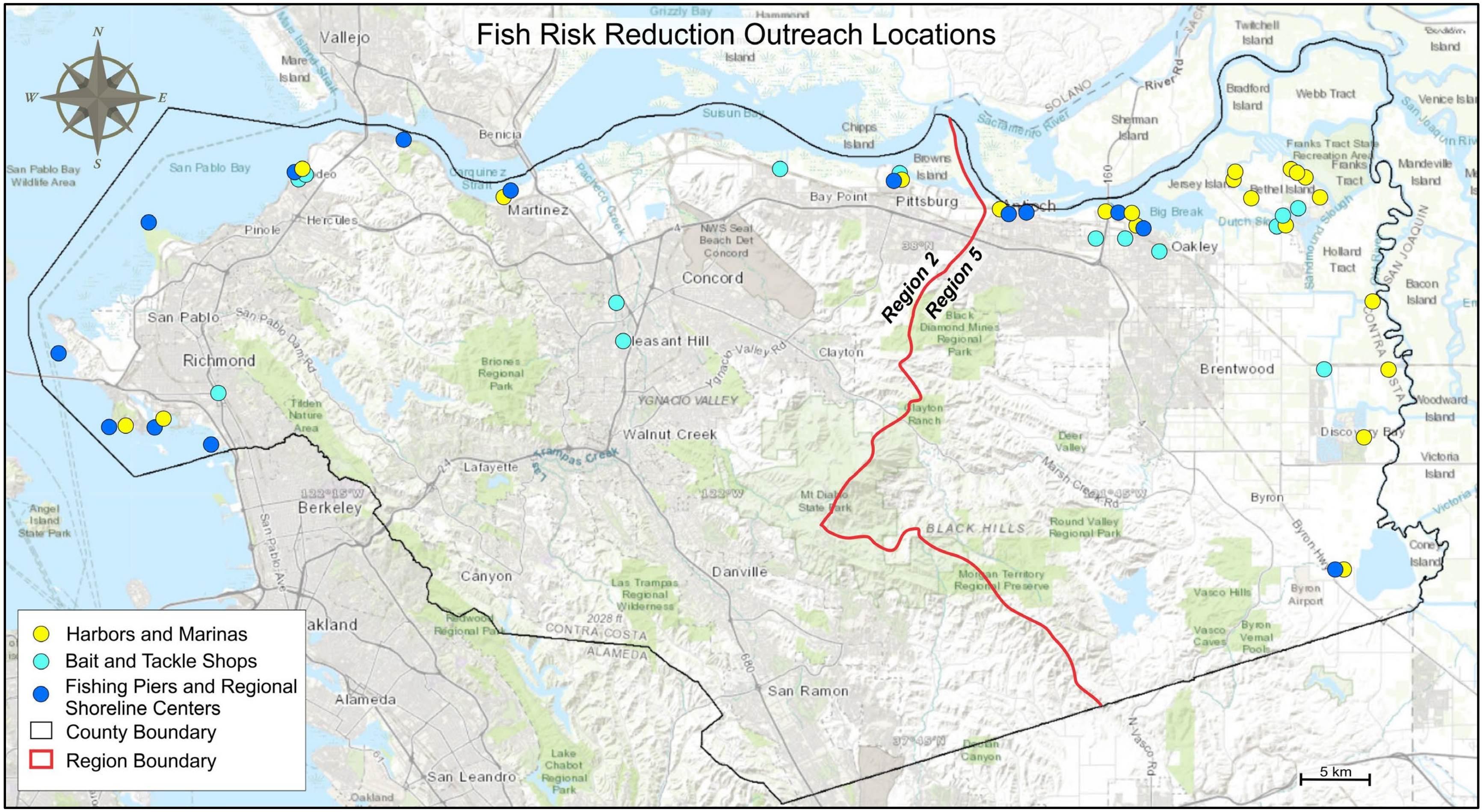

Figure 7. **2022 Fish Risk Reduction Outreach Locations**

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4 REFERENCES

San Francisco Bay Regional Water Quality Control Board (SFBRWQCB). 2015. California Regional Water Quality Control Board, San Francisco Bay Region. Municipal Regional Stormwater NPDES Permit, Order No. R2-2015-0049, Permit No. CAS612008. November 19, 2015.

San Francisco Bay Regional Water Quality Control Board (SFBRWQCB). 2019. California Regional Water Quality Control Board, San Francisco Bay Region. Municipal Regional Stormwater NPDES Permit, Order No. R2-2019-0049, Permit No. CAS612008. November 2019.

Office of Environmental Health Hazard Assessment (OEHHA). 2018a. A Guide To Eating Fish Caught from the Central and South Delta. Sept. 21, 2018. https://oehha.ca.gov/media/downloads/advisories/deltacentralsouthposter082418.pdf

Office of Environmental Health Hazard Assessment (OEHHA). 2018b. A Guide to Eating Fish from San Francisco Bay. March 12, 2018. https://oehha.ca.gov/media/downloads/advisories/sfbayposter031218.pdf

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ATTACHMENT 1: FISH RISK FLYERS

Images of the fish risk flyers can be found at the following links:

https://oehha.ca.gov/media/downloads/advisories/sfbayposter031218.pdf

https://oehha.ca.gov/media/downloads/advisories/deltacentralsouthposter082418.pdf

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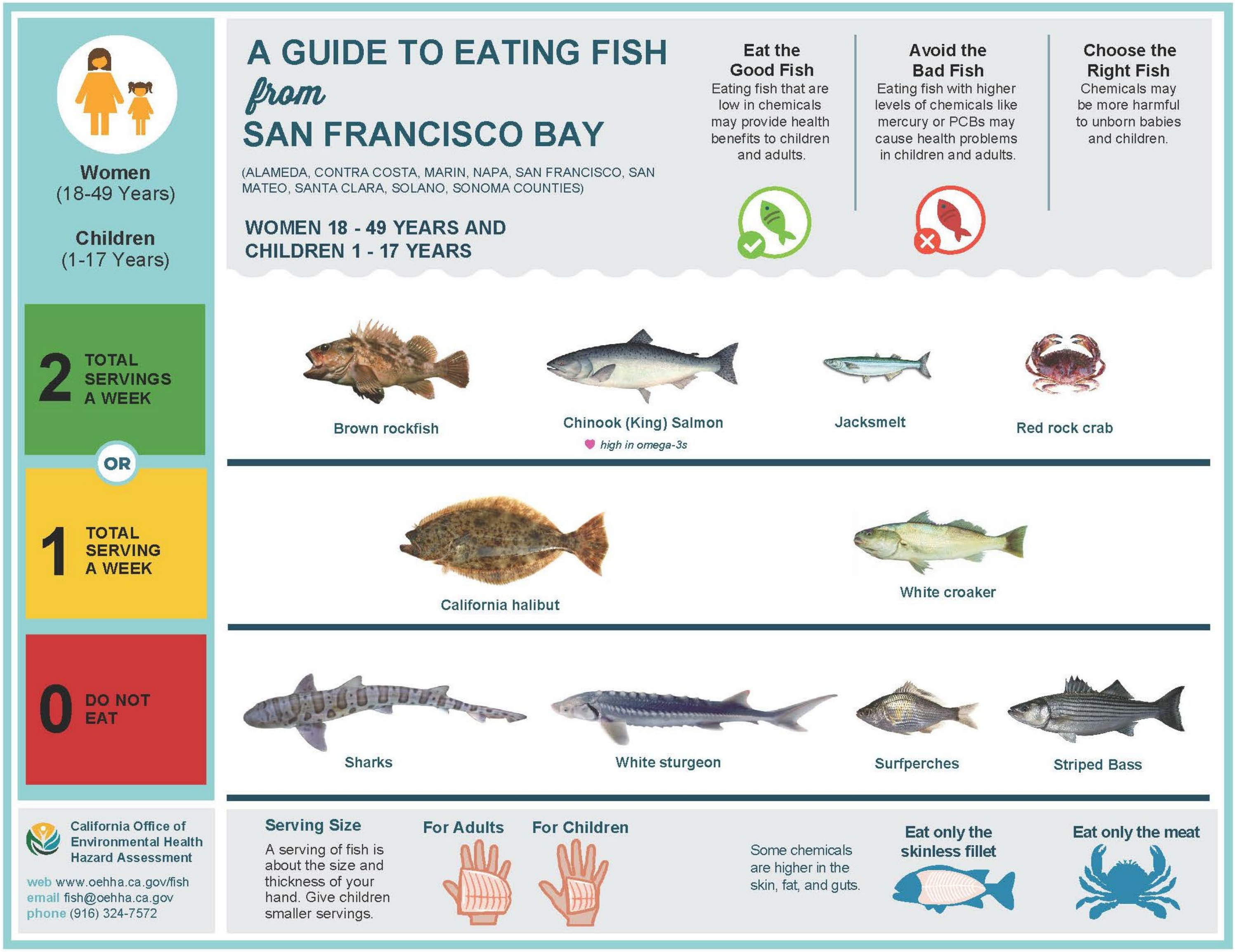
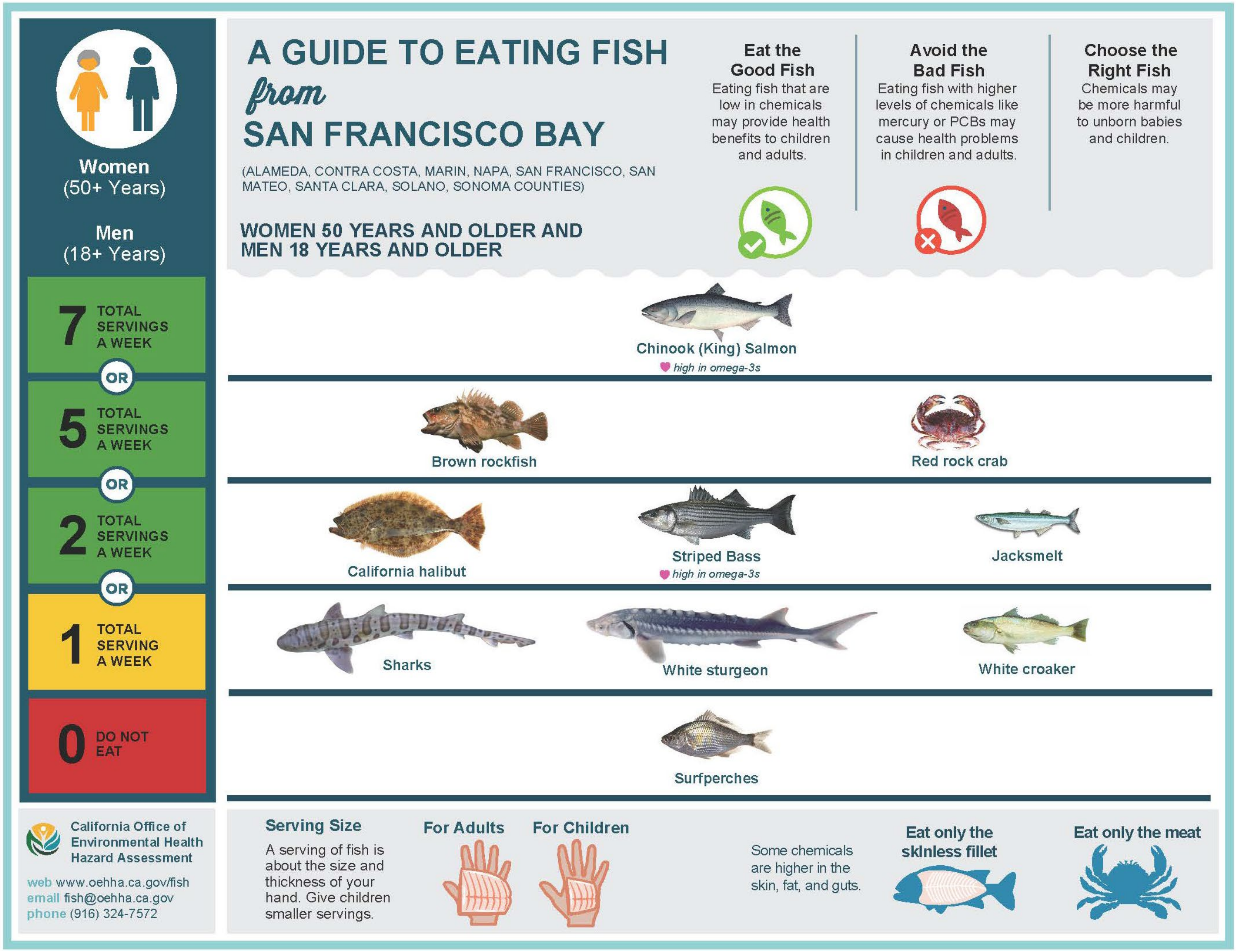
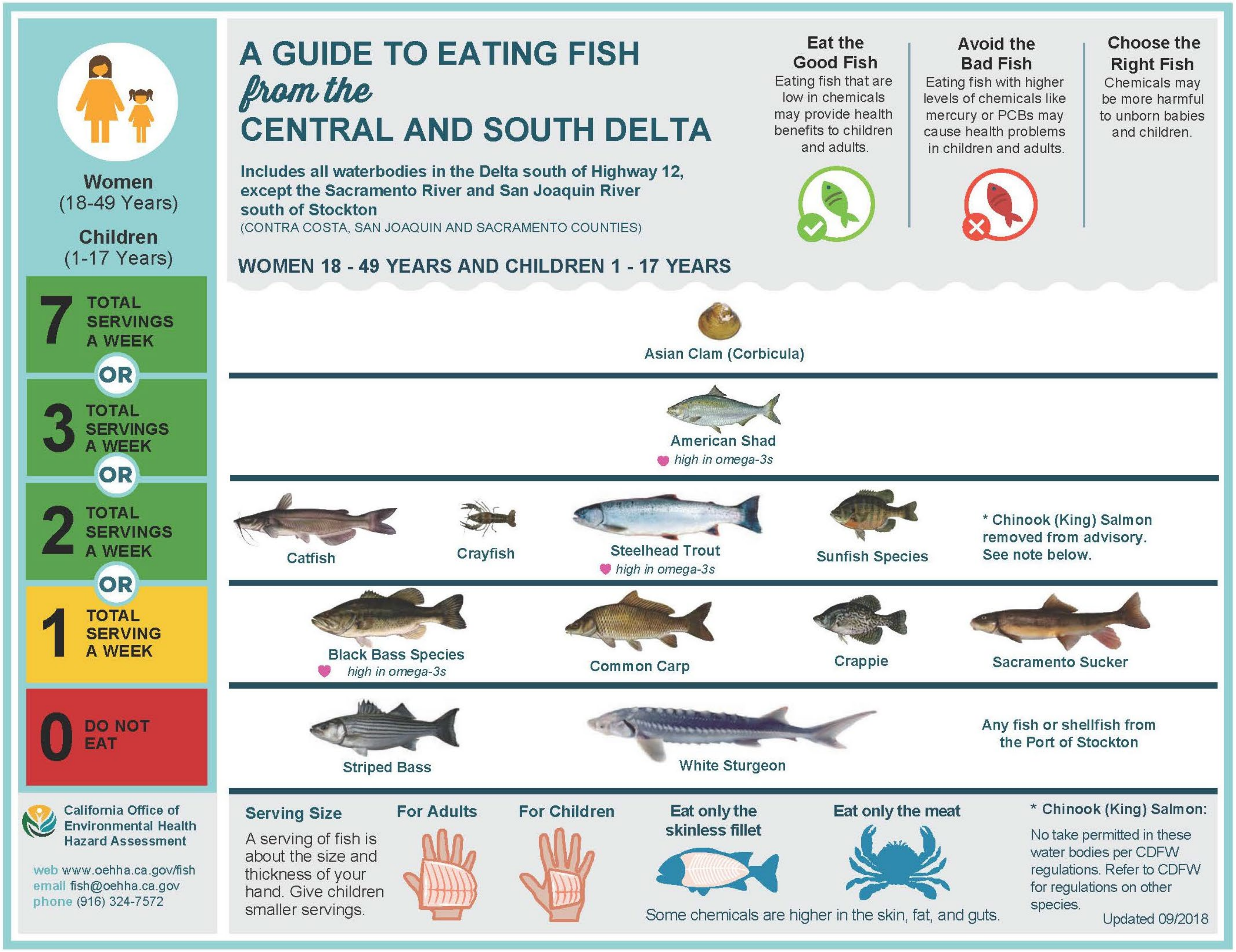
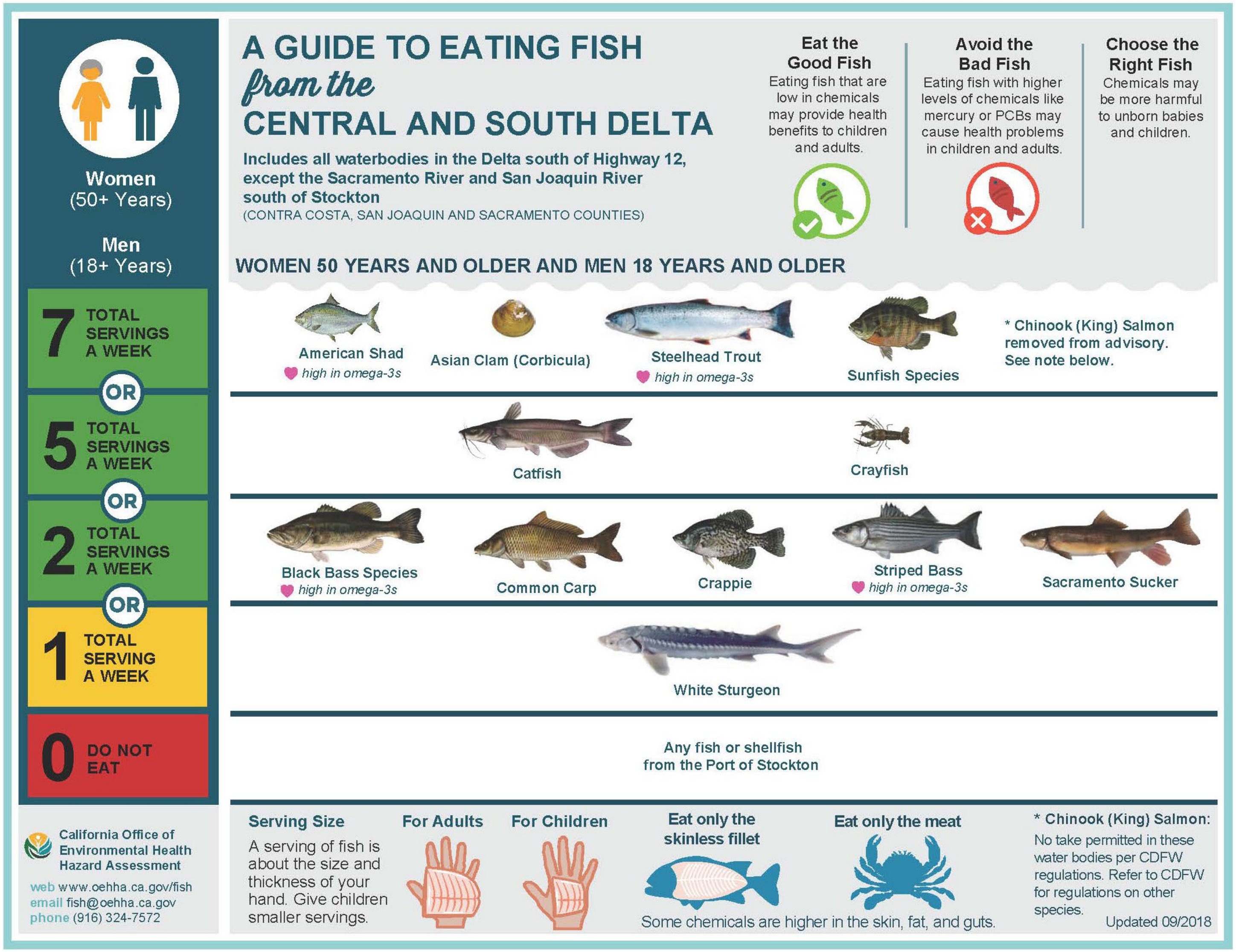

Women
(18-49 Years)
Children
(1-17 Years)
A GUIDE TO EATING FISH
from
SAN FRANCISCO BAY
(ALAMEDA, CONTRA COSTA, MARIN, NAPA, SAN FRANCISCO, SAN MATEO, SANTA CLARA, SOLANO, SONOMA COUNTIES)
WOMEN 18 - 49 YEARS AND CHILDREN 1 - 17 YEARS
Eat the Good Fish
Eating fish that are low in chemicals may provide health benefits to children and adults.
Avoid the Bad Fish
Eating fish with higher levels of chemicals like mercury or PCBs may cause health problems in children and adults.
Choose the Right Fish
Chemicals may be more harmful to unborn babies and children.
2 TOTAL SERVINGS A WEEK
Brown rockfish
Chinook (King) Salmon
high in omega-3s
Jacksmelt
Red rock crab
OR
1 TOTAL SERVING A WEEK
California halibut
White croaker
0 DO NOT EAT
Sharks
White sturgeon
Surfperches
Striped Bass
California Office of Environmental Health Hazard Assessment
web www.oehha.ca.gov/fish
email fish@oehha.ca.gov
phone (916) 324-7572
Serving Size
A serving of fish is about the size and thickness of your hand. Give children smaller servings.
For Adults
For Children
Some chemicals are higher in the skin, fat, and guts.
Eat only the skinless fillet
Eat only the meat


A GUIDE TO EATING FISH
from
SAN FRANCISCO BAY
(ALAMEDA, CONTRA COSTA, MARIN, NAPA, SAN FRANCISCO, SAN MATEO, SANTA CLARA, SOLANO, SONOMA COUNTIES)
WOMEN 50 YEARS AND OLDER AND MEN 18 YEARS AND OLDER
Women (50+ Years)
Men (18+ Years)
Eat the Good Fish
Eating fish that are low in chemicals may provide health benefits to children and adults.
Avoid the Bad Fish
Eating fish with higher levels of chemicals like mercury or PCBs may cause health problems in children and adults.
Choose the Right Fish
Chemicals may be more harmful to unborn babies and children.
7 TOTAL SERVINGS A WEEK
Chinook (King) Salmon
high in omega-3s
OR
5 TOTAL SERVINGS A WEEK
Brown rockfish
Red rock crab
OR
2 TOTAL SERVINGS A WEEK
California halibut
Striped Bass
high in omega-3s
Jacksmelt
OR
1 TOTAL SERVING A WEEK
Sharks
White sturgeon
White croaker
0 DO NOT EAT
Surfperches
California Office of Environmental Health Hazard Assessment
web www.oehha.ca.gov/fish
email fish@oehha.ca.gov
phone (916) 324-7572
Serving Size
A serving of fish is about the size and thickness of your hand. Give children smaller servings.
For Adults
For Children
Some chemicals are higher in the skin, fat, and guts.
Eat only the skinless fillet
Eat only the meat


A GUIDE TO EATING FISH
from the
CENTRAL AND SOUTH DELTA
Includes all waterbodies in the Delta south of Highway 12, except the Sacramento River and San Joaquin River south of Stockton
(CONTRA COSTA, SAN JOAQUIN AND SACRAMENTO COUNTIES)
WOMEN 18 - 49 YEARS AND CHILDREN 1 - 17 YEARS
Eat the Good Fish
Eating fish that are low in chemicals may provide health benefits to children and adults.
Avoid the Bad Fish
Eating fish with higher levels of chemicals like mercury or PCBs may cause health problems in children and adults.
Choose the Right Fish
Chemicals may be more harmful to unborn babies and children.
Women (18-49 Years)
Children (1-17 Years)
7 TOTAL SERVINGS A WEEK
OR
3 TOTAL SERVINGS A WEEK
OR
2 TOTAL SERVINGS A WEEK
OR
1 TOTAL SERVING A WEEK
0 DO NOT EAT
Asian Clam (Corbicula)
American Shad
high in omega-3s
Catfish
Crayfish
Steelhead Trout
high in omega-3s
Sunfish Species
* Chinook (King) Salmon removed from advisory. See note below.
Black Bass Species
high in omega-3s
Common Carp
Crappie
Sacramento Sucker
Striped Bass
White Sturgeon
Any fish or shellfish from the Port of Stockton
California Office of Environmental Health Hazard Assessment
web www.oehha.ca.gov/fish
email fish@oehha.ca.gov
phone (916) 324-7572
Serving Size
A serving of fish is about the size and thickness of your hand. Give children smaller servings.
For Adults
For Children
Eat only the skinless fillet
Eat only the meat
Some chemicals are higher in the skin, fat, and guts.
* Chinook (King) Salmon:
No take permitted in these water bodies per CDFW regulations. Refer to CDFW for regulations on other species.
Updated 09/2018


Women
(50+ Years)
Men
(18+ Years)
7 TOTAL SERVINGS A WEEK
OR
5 TOTAL SERVINGS A WEEK
OR
2 TOTAL SERVINGS A WEEK
OR
1 TOTAL SERVING A WEEK
0 DO NOT EAT
A GUIDE TO EATING FISH
from the
CENTRAL AND SOUTH DELTA
Includes all waterbodies in the Delta south of Highway 12, except the Sacramento River and San Joaquin River south of Stockton
(CONTRA COSTA, SAN JOAQUIN AND SACRAMENTO COUNTIES)
Eat the Good Fish
Eating fish that are low in chemicals may provide health benefits to children and adults.
Avoid the Bad Fish
Eating fish with higher levels of chemicals like mercury or PCBs may cause health problems in children and adults.
Choose the Right Fish
Chemicals may be more harmful to unborn babies and children.
WOMEN 50 YEARS AND OLDER AND MEN 18 YEARS AND OLDER
American Shad
high in omega-3s
Asian Clam (Corbicula)
Steelhead Trout
high in omega-3s
Sunfish Species
* Chinook (King) Salmon removed from advisory. See note below.
Catfish
Crayfish
Black Bass Species
high in omega-3s
Common Carp
Crappie
Striped Bass
high in omega-3s
Sacramento Sucker
White Sturgeon
Any fish or shellfish from the Port of Stockton
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web www.oehha.ca.gov/fish
email fish@oehha.ca.gov
phone (916) 324-7572
Serving Size
A serving of fish is about the size and thickness of your hand. Give children smaller servings.
For Adults
For Children
Eat only the skinless fillet
Eat only the meat
Some chemicals are higher in the skin, fat, and guts.
* Chinook (King) Salmon:
No take permitted in these water bodies per CDFW regulations. Refer to CDFW for regulations on other species.
Updated 09/2018

Contra Costa Clean Water Program

Regional/Statewide Supplemental Reports

BAMSC Annual Reporting for FY 2021-2022, Regional Supplement for New Development and Redevelopment

CASQA Annual Reporting for FY 2021-2022, Our Water Our World Annual Summary Report

CASQA Pesticides Subcommittee Annual Report and Effectiveness Assessment 2021-2022

Annual Reporting for FY 2021-2022

Regional Supplement for New Development and Redevelopment

San Francisco Bay Area Municipal Regional Stormwater Permit

Bay Area Municipal Stormwater Collaborative

September 2022

MRP Regional Supplement for New Development and Redevelopment
Annual Reporting for FY 2021-2022

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LIST OF ATTACHMENTS

INTRODUCTION

This Regional Supplement has been prepared to report on regionally implemented activities complying with portions of the Municipal Regional Stormwater Permit (MRP), issued to 79 municipalities and special districts (Permittees) by the San Francisco Bay Regional Water Quality Control Board (Water Board). The Regional Supplement covers new development and redevelopment activities related to the following MRP 2.0 provision:

- C.3.j.iii. Participate in Processes to Promote Green Infrastructure.

These regionally implemented activities were conducted under the auspices of the Bay Area Municipal Stormwater Collaborative (BAMSC), an informal coalition of the municipal stormwater programs in the San Francisco Bay Area. [1] Most of the 2021-22 annual reporting requirements of Provision C.3.j.iv covered in this Supplement were completely met by BAMSC member activities, except where otherwise noted herein or by Permittees in their reports. MRP Permittees, through their program representatives on the BAMSC Steering Committee and its Subcommittees, collaboratively participated in these BAMSC informal regional activities.

GREEN INFRASTRUCTURE PLANNING AND IMPLEMENTATION

C.3.j.iii. Participation in Processes to Promote Green Infrastructure

This provision requires:

(1) The Permittees shall, individually or collectively, track processes, assemble and submit information, and provide informational materials and presentations as needed to assist relevant regional, State, and federal agencies to plan, design, and fund incorporation of green infrastructure measures into local infrastructure projects, including transportation projects. Issues to be addressed include coordinating the timing of funding from different sources, changes to standard designs and design criteria, ranking and prioritizing projects for funding, and implementation of cooperative in-lieu programs.

This section describes activities and accomplishments during FY 21-22 to promote green infrastructure (GI or GSI). The BAMSC activities described in this section provide compliance for MRP Permittees with this provision.

[1] In late FY 20-21, the predecessor to BAMSC, the Bay Area Stormwater Management Agencies Association (BASMAA), dissolved as a formal non-profit organization and its members continued to meet as an informal organization under the name Bay Area Municipal Stormwater Coalition (BAMSC). BAMSC members jointly prepared this Regional Supplement for FY 21-22.

Activities and Accomplishments during FY 21-22

MRP 3.0 C.3/GI Work Group

Countywide Program and Permittee staff actively participated in the BAMSC MRP 3.0 C3/GI Work Group to discuss, internally and with Water Board staff, issues to be addressed in Provision C.3 of MRP 3.0, including requirements for long-term and short-term implementation of GI. The Work Group proposed an approach for setting short-term requirements in the context of long-term GI implementation goals that would be established via a Technical Working Group (TWG) including Water Board staff and outside science experts from EPA, SFEP, SFEI, and other organizations. The TWG will begin meeting in FY 22-23 to discuss long-term goals for GI and reductions in impervious surfaces at individual, countywide and regional scales.

In FY 21-22, the C.3/GI Work Group met once with Water Board staff to discuss the MRP 3.0 Revised Tentative Order, in addition to holding several internal meetings and conducting some smaller group meetings with Water Board staff on focused topics. Key issues discussed included: regulated project thresholds; regulation of single-family homes; regulation of road maintenance and reconstruction projects; alternative compliance options, Special Projects provisions, asset management, and future GI requirements. At the May 11, 2022 Regional Water Board Adoption Hearing for MRP 3.0, the current Co-Chair of the BAMSC, Reid Bogert, presented testimony to the Regional Water Board members and hearing participants, focusing on the impacts of proposed C.3 provisions of the reissued permit and proposed strategies for improving implementation outcomes.

San Francisco Estuary Blueprint 2022 Update

The San Francisco Estuary Partnership's (SFEP's) *San Francisco Estuary Blueprint* (Blueprint), formerly known as the Comprehensive Conservation and Management Plan, is a living collaborative agreement, updated every five years, about what should be done to protect and restore the Estuary. The 2022 update of the 2016 Blueprint focused on revisions at the specific action and task levels. Action 19 and Tasks 19-1, 19-2, and 19-3 address management of stormwater with low impact development and GSI. BAMSC members worked with Josh Bradt of the SFEP to provide input on task descriptions and ways that BAMSC would be a collaborative partner in implementing these tasks. The stormwater management (Action 19) section of the final 2022 Blueprint is provided as Attachment 1.

BAMSC Development Subcommittee

The BAMSC Development Subcommittee continued to meet approximately quarterly during FY 21-22 and promoted implementation of GI by providing a forum to discuss the following topics:

- GI operation and maintenance (O&M), including the City of San Jose's GSI O&M Manual;
- Compost and mulch practices, including a new biotreatment area wood mulch specification;
- Bioretention vegetation selection and maintenance, including SCVURPPP's GSI Vegetation Guide and Contra Costa County's drought-tolerant plant list;

- Case studies of rain water harvesting and rain garden rebate programs implemented throughout the region, including in San Mateo County, the City of Cupertino and Valley Water.

The Development Subcommittee's Biotreatment Soil Media (BSM)-Tree-Design Work Group also met once during FY 21-22 and discussed trees in bioretention, tree well filter designs, and the bioretention wood mulch specification. The Santa Clara Valley Urban Forestry Alliance is a new organization that is now participating in this work group.

Other Participation and Comments

- Green Streets for Sustainable Communities Symposium and Work Group – In the fall of 2020, Jill Bicknell and Vishakha Atre (EOA, representing SCVURPPP) and Matt Fabry (C/CAG) worked with the organization Transportation Choices for Sustainable Communities (TCSC) to plan and conduct a "Green Streets for Sustainable Communities" Symposium. The purpose of the symposium was to bring together elected officials, city staff leaders, stormwater experts, complete street/transportation experts, environmental activists, tree and urban ecology experts, and other stakeholders to explore how to better fund, design, build, manage and maintain streets to optimize performance for people and nature. Details and presentation videos can be found on the TCSC website. Following the symposium, SCVURPPP staff participated in meetings of the TCSC Green Streets Work Group during FY 20-21 and FY 21-22. The Work Group worked on follow-up actions to the Symposium, such as: 1) development of draft language for Sustainable Streets legislation; 2) meetings with State legislators and City Council members to promote sustainable streets; and 3) development of a presentation to elected officials on the need for and benefits of sustainable streets.

- Reid Bogert (SMCWPPP) – Presentation at the Silicon Valley Bicycle Coalition Annual Bike Summit on August 13, 2021 on the San Mateo Countywide Sustainable Streets Master Plan outcomes: "Tooling Up Sustainable Streets in San Mateo County".

- Reid Bogert (SMCWPPP) – Presentation at 2021 CASQA Conference: "Calm Before the Storm: San Mateo County Sustainable Streets Master Plan". Project received 2021 CASQA Award for Outstanding Sustainable Stormwater Project or Program.

- Reid Bogert (SMCWPPP) – Moderated panel at 2021 CASQA Conference on "Advancing Collaborative Approaches to Regional-Scale Stormwater Management" – the Regional Collaborative Program Framework White Paper developed under this grant funded project focused on evaluating countywide opportunities for regional-scale multi-benefit stormwater capture projects and regional programmatic implementation of distributed GI, establishing the business case for a regional collaborative approach, advancing innovative funding and financing, and developing additional concept designs for high performing regional projects.

- Reid Bogert (SMCWPPP) – Participated in a panel at the 2021 CASQA Conference on "Co-funding Stormwater Incentives Through 'Stacked Incentives'".

- Reid Bogert (SMCWPPP) – Presentation at the February California Stormwater Quality Association Funding Subcommittee on "Advancing Regional-Scale Stormwater Management in San Mateo County CASQA Funding Subcommittee" including an emphasis on advancing planning and funding for multi-benefit, regional-scale stormwater projects.

- Reid Bogert (SMCWPPP) – Presentation at the Bay Area Water Supply Conservation Agency's Water Supply Reliability Roundtable in June, focusing on the "Advancing Regional Scale Stormwater Management in San Mateo County" project and identifying opportunities and barriers for integrated water planning (i.e., One Water) strategies in the Bay Area.

- Reid Bogert (SMCWPPP) – Project manager for Climate Resiliency Resources Guide for GI Leadership Exchange. This Collaborative Grant Program project under the GI Leadership Exchange developed a comprehensive North American scale guide focused on creating resources for integrating climate adaptation into municipal GI programming and project implementation with detailed considerations and next step recommendations for advancing this work in the areas of policy, planning, design and operations and maintenance.

- Reid Bogert (SMCWPPP) – Discussions with state legislators and staff on the development of the proposed 2022-23 Drought and Resilience Appropriations Legislation to request specific categories of funding for green stormwater infrastructure and reduced matching requirements for implementing grant programs.

Attachments

Attachment 1

San Francisco Estuary Blueprint 2022

Action 19, Stormwater Management

ACTION 19 STORMWATER MANAGEMENT

Manage stormwater with low impact development and green stormwater infrastructure.

Implement Low Impact Development (LID) and Green Stormwater Infrastructure (GSI) to reduce polluted stormwater to the Estuary. Develop planning and tracking tools, technical materials, policy recommendations, and financing strategy guidance to aid agencies with implementation.

GOALS

Living Resources | Resilience | Water | Stewardship

TASK 19-1

Expand funding opportunities for Green Stormwater Infrastructure (GSI) planning and implementation, including those identified in the Roadmap of Funding Solutions for Sustainable Streets. Expand effort to engage utility agencies that also maintain infrastructure in the public realm to increase collaboration and cooperation.

MILESTONE
10 stormwater management/transportation planning meetings with Metropolitan Transportation Commission, San Francisco Bay Regional Water Quality Control Board, and others.

COST ESTIMATE – $

TASK 19-2

Improve the San Francisco Bay Low Impact Development (LID) Tracker Tool and the process to efficiently receive pertinent GSI project information reported to the San Francisco Bay Regional Water Quality Control Board to increase the number of projects in the Tracker Tool and allow reporting on the cumulative pollutant reduction effectiveness of GSI projects on the water quality of San Francisco Bay.

MILESTONE
A permanent agency home and budget for the LID Tracker Tool with budget for coordination with municipalities and countywide clean water programs, project data compilation and entry, and ongoing software maintenance.

COST ESTIMATE – $$

TASK 19-3

Pilot an alternative or in-lieu LID compliance Compliance program for San Francisco Bay Regional Water Quality Control Board that demonstrates to municipalities a programmatic approach to alternative compliance that can provide funding for both capital implementation and long-term operations of multi-benefit Green Stormwater Infrastructure, and result in projects that provide a net environmental benefit or equivalent or increased water quality benefit.

MILESTONE
San Francisco Bay Regional Water Quality Control Board-approved alternative compliance pilot program with two public projects identified for receiving resources from regulated project proponents.

COST ESTIMATE – $$$

TASK 19-4

Develop a stormwater asset management module within the Metropolitan Transportation Commission's StreetSaver Program to help Bay Area municipal jurisdictions improve inventory, inspection, and maintenance of storm drain and green infrastructure assets along streets.

MILESTONE
Revised StreetSaver Program that includes a stormwater asset management module consistent with requirements in stormwater permits.

COST ESTIMATE – $$

Photo: Lonny Meyer

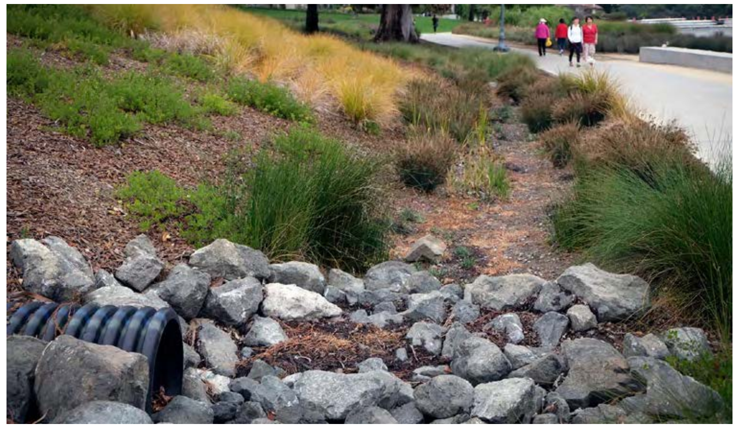
Photo: Jennifer Krebs

Cost Estimate Key		
$ - Up to $100,000	$$ - Up to $1 million	$$$$ - Up to $100 million
	$$$ - Up to $10 million	$$$$$ - Over $100 million

Overview
In cities around the region, impervious surfaces such as streets and sidewalks typically represent 15-25 percent of land cover. Impervious surfaces prevent stormwater from being filtered through the soil, resulting in stormwater runoff that carries pollutants like oil, grease, pesticides, and heavy metals down drains and straight into the Estuary. As climate change brings more extreme weather events to the Estuary, green stormwater infrastructure (GSI) and low impact development (LID) installations can reduce runoff volumes and distribute runoff into inlets across a longer period of time, helping to reduce the impacts of urbanization on local hydrology and water quality.

Updates and Emerging Issues
Since 2016, this Action's focus has shifted from planning to implementation, with projects being tracked regionally via an LID Tracker Tool, built by the San Francisco Estuary Institute to be compatible with other GIS-based software programs. Additionally, this Action now explores creative ways to fund stormwater infrastructure projects, such as an in-lieu alternative compliance pilot program that would allow cities to get GSI funding from private projects where on-site treatment is infeasible. While the action is focused on the Estuary due to San Francisco Bay Regional Water Quality Control Board requirements and intense urbanization, LID/GSI is an effective strategy in Delta watersheds as well.

Climate Change Considerations
Climate change will bring more extreme weather events to the Estuary, causing periods of drought and periods of intense precipitation. GSI/LID installations can distribute runoff into inlets over a longer period of time, helping reduce flooding caused by overwhelmed stormwater systems.

Equity Considerations
GI/LID techniques often improve community aesthetics and create more pedestrian friendly spaces, which are needed in many underserved communities. However, these projects can also raise property values and lead to green gentrification, further exacerbating displacement in communities already vulnerable to hot real estate markets.

Connections to Other Actions
The use of GSI/LID to prevent water pollution and flooding hazards closely connects this action with:

A1: Climate Resilience

A2: Equity

A3: Adaptation Planning

A4: Adaptation Implementation

A18: Recycled Water

A20: Nutrients

A21: Emerging Contaminants

A22: Health Risks of Contaminants

Attachments

Attachment 2

Green Infrastructure Leadership Exchange

Climate Resilience Resources Guide: Part 1

August 2022

Climate Resilience Resources Guide: Part 1

August 2022

Acknowledgments

The Green Infrastructure Leadership Exchange | Project Manager
Green Infrastructure Leadership Exchange ("the Exchange") strives to accelerate the affordable and equitable implementation of green stormwater infrastructure (GSI) throughout North America by supporting peer learning, innovation and collaboration among cities, counties, and utilities. We're a highly connected peer learning network that offers a platform for practitioners to share experiences, circulate ideas, and solve problems together toward finding more sustainable water infrastructure solutions. The Exchange is a project of the Global Philanthropy Partnership. For more, visit giexchange.org.

Geosyntec Consultants | Lead Author
Geosyntec Consultants is a highly respected, top-tier geo-environmental consulting and engineering firm that works closely with public and private sector clients to address complex environmental, natural resources, and civil infrastructure problems. Geosyntec has over 100 water and natural resources practitioners nationwide known for their innovative work in stormwater and surface water quality management; hydromodification management; Best Management Practice (BMP) selection, design, and optimization; and erosion and sediment control. Geosyntec provides a thorough understanding of technical, practical, and regulatory issues to support clients in making informed management decisions. For more, visit geosyntec.com

Statements and views expressed in this Guide are solely those of the authors and do not imply endorsement by the Global Philanthropy Partnership.

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1. INTRODUCTION

This Climate Resilience Resources Guide (Guide) explores the intersection of green stormwater infrastructure (GSI) and urban impacts from climate change. GSI is a decentralized approach to stormwater management that mimics natural hydrology by slowing and/or retaining runoff generated from rainfall. Resilience-focused policy, planning, and implementation of GSI could make communities more resilient to climate change while providing human health benefits. However, existing planning, design, and maintenance standards for GSI might leave this infrastructure at risk of not performing per current stormwater regulations or being damaged because of the impacts of a changing climate. This Guide explores potential changes to current GSI policy, planning, and implementation practices that could enhance the climate resilience benefits provided by GSI and considers how climate change could negatively impact GSI performance.

The primary target audience for this Guide includes municipal staff, decision-makers, and regulatory entities. Recommendations in this Guide may also be helpful for community members and stakeholders to advocate, plan, implement, and maintain GSI.

This Guide examines decision-making processes for planning and implementing GSI based on climate resilience, public engagement, and equity considerations. The Guide references relevant resources throughout, including frameworks for considering equity in GSI planning and finding and utilizing downscaled climate model projections. A full matrix of resources is provided in Appendix A. The Guide and matrix are intended to be living documents that are updated and expanded over time. This Guide includes a roadmap for further advancing this work through the Green Infrastructure Leadership Exchange.

2. BACKGROUND

2.1 Stormwater Management Strategies

This section defines GSI and discusses its interrelationship with other stormwater management strategies, including grey stormwater infrastructure and larger nature-based solutions, to address water quality regulatory requirements and climate resilience goals.

2.1.1 Green Stormwater Infrastructure

Infrastructure is the basic equipment and structures essential for functional, healthy, and vibrant communities.[1] "Green" stormwater infrastructure (GSI) includes a range of measures that are engineered to passively capture and treat stormwater using natural processes. GSI measures are decentralized or "distributed", that is, they capture, slow, and infiltrate rain where it falls, thus reducing local stormwater runoff and improving the health of surrounding waterways.[2] The primary treatment mechanisms that GSI uses include:

- Retention (i.e., preventing discharge) of stormwater runoff through infiltration to the subsurface, evapotranspiration, or capture and use;
- Filtration of stormwater runoff through vegetation and biologically active treatment media (i.e., biofiltration); and
- Treatment using passive biological processes (i.e., biotreatment) to treat stormwater runoff before discharge.

GSI measures are intentionally sized and designed to meet water quality regulatory requirements or provide other specific hydrologic benefits. GSI typically uses vegetation and engineered soil or media systems; permeable pavement or other permeable surfaces or substrates; and/or storage for subsequent use.

Typical types of GSI, organized by treatment mechanism, include:

- Infiltration measures, including infiltration basins, infiltration trenches, bioretention,[i] drywells, and permeable pavement;
- Practices to promote evapotranspiration, including tree planting, green roofs, and impervious surface dispersion;
- Rainwater harvesting (i.e., cisterns or rain barrels);
- Biofiltration, including bioretention, planter boxes, vegetated swales, vegetated filter strips, and proprietary biotreatment devices; and
- Biotreatment basins, such as wet detention basins and constructed wetlands.

This document uses "GSI" to refer to these measures or "GI" when a cited report uses this acronym instead. GSI measures are also implemented at different scales, including:

- Street-scale facilities or “green streets”, such as curb extensions and bulb-outs designed to treat roadway runoff;
- Parcel-based facilities, which are GSI measures sized to treat an entire parcel; and
- Regional facilities, which are GSI measures that treat runoff generated from a larger area, such as a neighborhood.

The ability of GSI to deliver multiple ecological, economic, and social benefits or services has made GSI an increasingly popular strategy. In addition to reducing polluted stormwater runoff, GSI practices can decrease urban heat, provide buffer for multi-modal transportation, reduce energy consumption, improve air quality, provide carbon sequestration, increase property prices, encourage nearby recreation, and provide other elements of community health and vitality that have monetary or social value.[3] Moreover, GSI measures provide flexibility to communities facing the need to adapt infrastructure to a changing climate. For more details on the benefits of GSI for climate adaptation, see Section 2.3.

[i] While bioretention primarily uses biofiltration as a treatment mechanism, it can be designed to infiltrate captured stormwater or treat and discharge it. When designed to infiltrate, bioretention is sometimes called “bioinfiltration”.

2.1.2 Grey Stormwater Infrastructure

Traditional "grey" stormwater infrastructure includes the curbs, gutters, catch basins, inlets, storm drain and sewer piping, detention basins, treatment plants, and outfalls used to collect and convey urban stormwater away from the built environment. Grey infrastructure collects and conveys stormwater from impervious surfaces, such as roadways, parking lots, and rooftops, into a series of piping that ultimately discharges stormwater into a local water body. Combined sewer systems (CSS) convey stormwater and various wastewater sources, typically to publicly operated treatment works (POTWs) designed to overflow. CSS and related POTW discharges of stormwater from overflows are regulated. Separate systems, which for public entities are known as municipal separate storm sewer systems (MS4s), only convey stormwater. Grey infrastructure is so-called because it is often constructed from concrete. It is designed to quickly convey stormwater and wastewater in and from urban environments and is often used to convey stormwater to and from GSI.

2.1.3 Other Nature-Based Solutions

Landscape or watershed scale nature-based solutions include large open natural spaces, riparian areas, wetlands, living shorelines, or greening of steep hillsides.[4] These broad-scale, "blue-green" solutions provide hydrology and water quality benefits (i.e., integrated stormwater management of flow and pollutants), and are also essential in the toolbox for climate change adaptation, providing ecological benefits and recreational opportunities. In addition, landscape features such as urban forest patches, parks, street trees, and living walls can provide similar benefits within the built environment. Another example, "Living Shorelines" are protected, stabilized coastal edges that contain natural materials such as plants, sand, shells, or rock[5] which can reduce erosion and property damage by reducing the velocity and intensity of waves.[6] While these larger features are often referred to as “green infrastructure”, they are typically not engineered to meet specific stormwater regulatory requirements, as GSI is (as defined by this Guide) and are not of focus in this Guide. Other examples of nature-based solutions not covered in this guide include measures focused on mitigating the impacts of extreme, back-to-back rainfall or "cloudburst" events[ii]. Copenhagen, Denmark, and New York City have studied and implemented projects that store and convey water where it is favorable during extreme rain events.[7] Examples include conveying water along the roadway's center (rather than the edges) or the use of a concave or sunken park for temporary flood storage.

Landscape features, and other broad-scale, nature-based solutions may be explored in future versions of this Guide.

2.2 Climate Change Impacts

This section summarizes the overall regional impacts of climate change in the U.S. and Canada and climate-related vulnerabilities for society and ecosystems. The implications of these impacts on GSI policy, planning, design, and operations and maintenance are discussed in Sections 4, 5, and 6, respectively.

2.2.1 Regional Climate-Related Impacts

The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body for assessing the science related to climate change. In the most recent Assessment Report (AR6[8]), the IPCC identifies 30 climatic impact drivers (CID) relevant to land and coastal regions. CIDs are physical climate system conditions (e.g., means, events, extremes) that affect an element of society or ecosystems. Depending on system tolerance, CIDs and their changes can be detrimental, beneficial, neutral, or a mixture of each across interacting system elements and regions.[9] The CIDs applicable to GSI policy, planning, and design include the following listed in Table 1.

[ii] Cloudburst management is the management of extreme back-to-back rainfall events through intentional flooding, conveying, and storing water where it is favorable in the landscape.

Table 1. Climatic Impact Drivers Relevant to GSI Policy, Planning, Design, and Operations and Maintenance[10]

Climatic Impact Driver	Explanation
Extreme heat	Temperature event of exceptionally high magnitude with a very rare occurrence, such as greater than the 90th percentile event.
Mean precipitation	Average precipitation.
River flood	Overflowing or accumulation of water over areas that are not normally submerged and often caused by unusually heavy rain. Fluvial floods are river floods versus rain (pluvial) floods.
Heavy precipitation with pluvial flood	Overflowing or accumulation of water over areas that are not normally submerged and often caused by unusually heavy rain. Pluvial floods are rain floods versus river (fluvial) floods.
Hydrological drought	A period with large runoff and water deficits in rivers, lakes, and reservoirs.
Fire weather	Weather conditions conducive to triggering and sustaining wildfires, usually based on a set of indicators and combinations of indicators including temperature, soil moisture, humidity, and wind. Does not include the presence or absence of fuel load.
Tropical cyclone	General term for strong, cyclonic-scale disturbance that originates over tropical oceans.
Snow, glacier, and ice sheet	Glacier is a perennial mass of ice and snow, and ice sheets are land masses of continental size.
Coastal flood	Overflowing or accumulation of water over areas that are not normally submerged and often caused by unusually heavy rain.

Figure 1 shows the direction of projected change (increase or decrease) for the nine CIDs in Table 1 for six regions in North America. The direction of change and confidence level is also shown in Figure 1. The future assessed changes refer to a 20 to 30-year period centered around 2050 and/or consistent with 2ºC (3.6ºF) global warming compared to a similar period within 1960-2014, except for hydrological drought, which is compared to 1850-1900.[11] In general, the northern, central, and eastern regions of North America are expected to have hotter and wetter extremes and, in some regions, more precipitation and fire weather. In western North America, future changes are expected to be hotter and drier, with wetter extremes in some regions.[12]

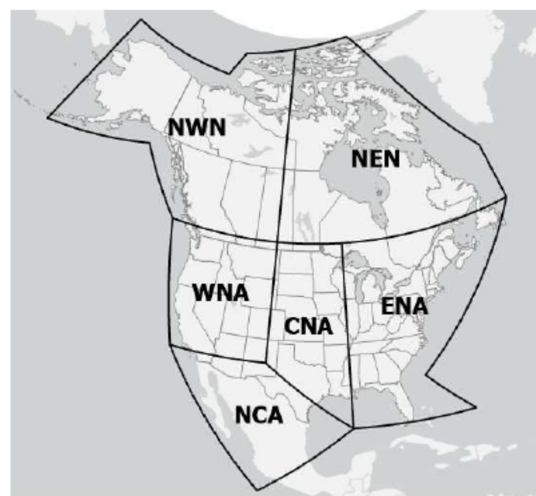
A list of tools for assessing past and future climate changes regionally and locally is provided in Table 2. Table 2 is not intended to be a comprehensive list of all available resources but a starting point for examining climate changes, providing examples of the types of tools available.

Region	Extreme Heat	Mean Precipitation	River Flood	Heavy Precipitation with Pluvial Flood	Hydrological Drought	Fire Weather	Snow, Glacier, Ice Sheet	Tropical Cyclone	Coastal Flood / Erosion
North-Western North America (NWN)	↑	↑	↑	↑		↑	↓		↑
North-Eastern North America (NEN)	↑	↑	↑	↑		↑	↓		↑
Western North America (WNA)	↑		↑	↑	↑	↑	↓		↑
Central North America (CNA)	↑		↑	↑		↑	↓	↑	↑
Eastern North America (ENA)	↑	↑	↑	↑		↑	↓	↑	↑
Northern Central America (NCA)	↑	↓		↑		↑	↓	↑	↑

Legend

High confidence of increase/decrease
Medium confidence of increase/decrease
Low confidence in direction of change or not relevant

Assessed future changes: Changes refer to a 20 to 30-year period centered around 2050 and/or consistent with 2C global warming, compared to a similar period within 1960-2014, except for hydrological drought which is compared to 1850-1900.



Source: IPCC Working Group 1 Interactive Atlas: Regional synthesis

Iturbide, M., Fernández, J., Gutiérrez, J.M., Bedia, J., Cimadevilla, E., Díez-Sierra, J., Manzanas, R., Casanueva, A., Baño-Medina, J., Milovac, J., Herrera, S., Cofiño, A.S., San Martín, D., García-Díez, M., Hauser, M., Huard, D., Yelekci, Ö. (2021) Repository supporting the implementation of FAIR principles in the IPCC-WG1 Atlas. Zenodo, DOI: 10.5281/zenodo.3691645. Available from: https://github.com/IPCC-WG1/Atlas

Gutiérrez, J.M., R.G. Jones, G.T. Narisma, L.M. Alves, M. Amjad, I.V. Gorodetskaya, M. Grose, N.A.B. Klutse, S. Krakovska, J. Li, D. Martínez-Castro, L.O. Mearns, S.H. Mernild, T. Ngo-Duc, B. van den Hurk, and J.-H. Yoon, 2021: Atlas. In Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L.Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K.Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press. In Press. Interactive Atlas available from Available from http://interactive-atlas.ipcc.ch/

Figure 1. Projected change (increase or decrease) for selected climatic impact drivers in six regions in North America.

Table 2. Tools for Assessing Past and Future Climate Changes

Resource	Region	Description
IPCC Working Group 1 Interactive Atlas	Global	A tool for global observed and projected regional climate change information as described in the IPCC Sixth Assessment Report, including regional synthesis for Climatic Impact-Drivers (CIDs).
Climate Data Extraction Tool (Canada)	Canada	A tool for viewing and downloading statistically downscaled climate scenarios for Canada.
Climate Data for a Resilient Canada	Canada	Provides high-resolution historic and future climate projection summaries for Canadian cities/towns.
The Climate Explorer	United States	A tool to explore how climate is projected to change in any county in the U.S., including Hawaii and the U.S. territories. Provides interactive graphs and maps showing past and projected climate conditions to support the U.S. Climate Resilience Toolkit.
Climate Information for Water Resource Managers	United States	Maps and graphics showing weather and climate outlooks across the U.S. Provides resources for short-term (<1 week) weather forecasts to medium-term (monthly) outlooks to future sea level rise and climate projections.
Cal-Adapt	California	Tool for viewing and downloading future climate change projection data at the local level for California.

2.2.2 Climate-Related Vulnerabilities

Vulnerability is a function of the sensitivity of a system or population and the adaptive capacity of the same.[13] Examples of climate-specific vulnerabilities are described below.

Human Health and Vulnerable Populations

Climate affects all areas of human health. Changes in air, water, food, and the environment will result in changes in the health and well-being of people. Increased heat waves, changes in precipitation, and sea-level rise affect health via multiple pathways. Human health risks associated with climate change are expected to increase in the future.

Some populations will be at higher risk from climate change impacts than others. Low-income communities and some communities of color are currently affected by health disparities and are less resilient to the human health impacts of climate change. Existing health issues in native tribes across the U.S. and Canada are expected to be exacerbated by multiple climate-related factors, including the loss of traditional foods and practices, community displacement, flooding, decreased food security, and new infectious diseases.[14,15] Children, older adults, low-income communities, some communities of color, and communities that experience discrimination are disproportionately affected by extreme weather and climate events.[16] Other groups that may experience disproportional impacts from climate change include outdoor workers, residents of areas with poor environmental quality, and poorer communities, especially in rural areas.[17] Communities with less access to information or support may be less able to avoid the health risks of climate change.[18]

Biodiversity

Biodiversity and species conservation is important for ecosystem balance and human populations (e.g., pollination of food crops). As the climate changes, many species are beginning to exhibit evolutionary adaptations in response.[19,20,21] However, projections suggest that climate change may occur too rapidly for some species to adapt. The capacity for adaption varies by species and even among populations of the same species.[22]

Changes in species ranges have been observed as a response to warming temperatures[23] as well as changes to migration patterns or life cycle events.[24] Climate change may increase invasive or non-native species,[25] leading to non-native species outcompeting native ones. Current and future stressors are projected to reduce the capacity of ecosystems to recover from extreme events like floods and fires. Climate change is projected to lead to losing iconic species from certain regions or becoming extinct altogether.[26]

Urban Heat Island

The urban heat island effect refers to the tendency for urban areas to absorb and release solar heat,[27] resulting in higher local surface temperatures. Reducing the urban heat island effect is important to maintaining human health and biodiversity. Larger temperature differences have been observed in humid regions (primarily the eastern United States) and cities with larger and denser populations.[28] The urban heat island effect is projected to become stronger as temperatures rise and urban areas densify and grow.

Water Scarcity/Water Stress

Water scarcity and water stress are affected by both human and natural systems. Factors associated with climate change include changes in the quantity and quality of water supplies, changes in soil moisture, sea-level rise, and the frequency of extreme events.[29] Human systems that interact with these impacts include the vulnerability of water infrastructure, water withdrawals, and water-use efficiency. The vulnerability of water supplies to climate change is currently unknown since risks depend on future decisions and actions.

2.3 GSI for Climate Resilience

"Resilience", as defined by the U.S. Climate Resilience Toolkit,[30] is "the capacity of a community, business, or natural environment to prevent, withstand, respond to, and recover from a disruption." GSI can be a valuable tool for communities to adapt to climate change and buffer against negative impacts. Many considerations can be incorporated into GSI planning and design to increase community resilience. Yet, at the same time, there are limitations to using GSI to solve all community climate-related challenges. GSI is a part of an extensive set of solutions to increase community resilience to climate change.

2.3.1 Managing Urban Flooding

The most apparent benefit for GSI to buffer against climate change impacts is the potential to reduce localized flooding associated with increased extreme precipitation (not including riverine or sea level rise related flooding). GSI can be designed to reduce runoff from larger precipitation events through infiltration and the incorporation of detention storage, reducing the potential of existing infrastructure becoming overwhelmed by storm events.[31] When GSI is implemented in coordination with other landscape features connecting urban hydrologic and vegetations systems, significant benefits can be achieved.

2.3.2 Preventing and Reducing Erosion

GSI implementation can provide benefits in mitigating creek and coastal erosion. Projected future increases in flooding can cause increased runoff volumes and flow rates, leading to creek erosion, bank incision, degradation, and related water quality issues in downstream receiving waters. In reconnecting the natural water cycle through runoff retention and infiltration in an urban watershed, GSI can reduce downstream hydrologic impacts. This can be implemented through GSI facilities at multiple scales, including street trees and green roofs, which can mitigate hydrologic effects in highly urban settings. Some erosive impacts related to sea-level rise and storm surges can be reduced through GSI facilities incorporating natural functions. Additional GSI benefits include improved habitat, water quality, and carbon sequestration.[32]

2.3.3 Reducing Urban Heat Impacts

Communities can reduce heat island impacts through GSI including vegetation and trees providing natural heat-regulating services, such as shading, evapotranspiration, and thermal insulation of buildings.[33] Planting urban trees that focus on urban hot spots can appreciably reduce urban heat impacts.[34] Strategies targeting buildings such as cool roofs or green roofs can reduce heat absorption while reducing the energy needed to cool buildings and improve stormwater runoff.[35] Vertical green structures such as vegetated facades and walls have been found to provide similar heat mitigation benefits to green roofs but at a smaller magnitude.[36]

2.3.4 Improving Air Quality

Urban trees, green roofs, and other vegetated GSI solutions can improve urban air quality, although the ability to do so is highly context dependent. GSI can improve air quality impacts on human health by introducing linear vegetative barriers between traffic and pedestrians.[37] Some evidence suggests that increased leaf area associated with certain GSI solutions can improve air quality by air pollution preferentially depositing onto vegetation.[38] However, implementation must be extensive enough to make an appreciable impact on ground-level air quality. For this reason, large "green walls" provide the most significant benefit for air quality.[39]

2.3.5 Water Supply Augmentation

Stormwater harvesting and groundwater replenishment from GSI can increase local water supplies, buffer against droughts, and reduce energy requirements and emissions associated with importing water from other locations.[40] Stormwater can serve a range of non-potable uses such as irrigation, toilet flushing, and cooling.

Through regional capture projects, stormwater may be used to recharge groundwater, improving local potable water supplies.[41] For example, the Orange Memorial Park Regional Stormwater Capture Project Park in South San Francisco will divert flow from a creek for water quality treatment, beneficial reuse (e.g., irrigation), and local flood reduction.[42] The project will offset an estimated 15 million gallons of potable water per year (resulting in $140,000 annually in water savings) and recharge 240 acre-ft to groundwater annually.

2.3.6 Human Health Benefits

GSI has been shown to improve human health outcomes across various categories[43] and can be utilized to address health disparities that may be exacerbated by climate change. Through proximity, passive recreation, or active recreation, people derive many positive benefits from GSI. Schools might be a focus area for GSI in many communities and adding greens spaces in schools has the potential to improve children's well-being, learning, and play while contributing to the ecological health and climate resilience of cities.[44]

Tree density and proximity to passive and active green spaces have been shown to provide physical, mental, and behavioral benefits.[45] Direct physical benefits of green space include improved cardiovascular health, reduced respiratory diseases, and reduced obesity.[46] Mental health benefits are associated with a reduced risk of depression, anxiety, and mood disorders.[47,48] Other benefits include a reduction in anti-social behaviors such as property and violent crime[49] and an improvement in helpful and generous behaviors.[50] Fewer studies are available on the human health benefits of specific types of GSI; however, similar benefits have been documented for green roofs, rain gardens, and bioswales.[51,52]

2.4 GSI and Equity

The effects of climate change disproportionately impact low-income and minority communities, and GSI can play an important role in improving environmental and social equity outcomes. Low-income neighborhoods are more likely to be near or within industrial areas and have fewer parks, street trees, and other green spaces.[53,54] In a recent study, McDonald et al.[55] showed that, on average, low-income blocks have 15.2% less tree cover and are 1.5ºC (2.7ºF) hotter than high-income blocks. In addition, minority neighborhoods are often at low elevations, vulnerable to sea-level rise and aging or failing stormwater infrastructure. These communities will disproportionally feel impacts from rising temperatures, urban heat island effects, poor air quality, and flooding, further contributing to inequity in health and well-being.[56]

By providing green spaces and a means for improved stormwater management, implementation of GSI in low-income and minority communities can help alleviate the negative impacts of climate change such as poor air quality, severe heat, and localized flooding. Integrating GSI projects with necessary infrastructure such as active transportation (e.g., bike lanes) and street improvement projects is significant for communities that rely most on public and active means of transportation.[57] Providing access to green spaces also can improve mental and physical health overall and can indirectly improve equity outcomes through visible investments that communicate worth.[58] As presented in the Equity Guide for GSI Practitioners,[59] well-designed green infrastructure programs can make direct contributions to equity in the following ways:

- Expand nature in communities,
- Increase resilience to climate hazards,
- Improve properties,
- Invest in economic stability,
- Create spaces that facilitate community cohesion,
- Increase community participation and power, and
- Build trust and acknowledge past harms.

It is critical to have equitable access to green spaces; however the distribution of GSI in urban planning is often itself inequitable. A joint study initiated in 2018 by the Cary Institute of Ecosystem Studies and the Urban Systems Lab assessed equity in GI Plans from 20 cities across the U.S. The researchers found that the patterns of urban greening tended to follow existing patterns of uneven urban development rooted in historical inequities (www.giequity.org). Furthermore, GSI is often implemented by municipalities when technically feasible based on physical site characteristics or necessary to support grey infrastructure projects, such as managing stormwater to reduce combined sewer overflows (CSOs) or improve water quality in streams (i.e., separate sewer systems).

It is important to consider multiple factors beyond engineering feasibility at the planning stages to address inequities in GSI implementation. At a workshop organized by NOAA and the Water Research Foundation in 2020, the organizers noted the importance of integrating physical science with social and infrastructure data to understand vulnerability, identify where improvements are most needed, and provide the most benefits.[60] Similarly, the U.S. Water Alliance suggests a cost-benefit approach and conducting triple-bottom-line analyses that include environmental, economic, and social impacts when selecting sites.[61]

"The City/County Association of Governments of San Mateo County has created a countywide Sustainable Streets Master Plan to help equitably adapt the roadway network to climate change and clean stormwater runoff to meet municipal stormwater regulatory requirements. Development of the Master Plan included an interwoven focus on equity, with prioritization criteria supporting projects in areas where 1) vehicle ownership is low and residents are more likely dependent upon active transportation or transit, 2) runoff volume is likely to increase the most due to climate change and lead to potential roadway flooding, 3) heat impacts are expected to worsen due to climate change, 4) multiple environmental or social vulnerable or disadvantaged community indicators overlap, and 5) there is lower tree canopy coverage that could benefit from increased urban greening."

Table 3 below provides links to useful resources for incorporating equity in GSI planning.

Table 3. Equity in GSI Planning Resources

GSI Equity Resource	Description
Equity Guide for GSI Practitioners	Resource developed through the Green Infrastructure Leadership Exchange by and for green infrastructure program managers offering a variety of tools to support practitioners in customizing community-informed equity work and evaluation plans.
Joint study by the Cary Institute of Ecosystem Studies and the Urban Systems Lab of 20 cities from across the U.S. assessing equity within GI Plans.	Key outputs from the project, including definitions for equity and green infrastructure, peer-reviewed publications, public presentations, and project-related web products.
GSI Toolkit for Equitable Investment – Georgetown Climate Center	How policymakers can design green infrastructure programs to prioritize environmental justice for communities facing disproportionate climate risk and pollution burden and resources that can be used to help fund projects in disadvantaged communities.
GSI Toolkit for Equitable Planning – Georgetown Climate Center	How to consider socioeconomic and other risk factors in green infrastructure planning.

2.5 Public Engagement, Communication, and Outreach

Early and consistent public engagement is necessary for success in GSI projects and is especially important for improving GSI equity outcomes. Engaging the public as early as possible in program or project planning is important to continue to work towards different types of equity goals.[62] When thinking about how to make a case for considering climate change, resilience, and the role of GSI, program managers should consider the following factors:

- Leadership, buy-in, and partnerships;
- Storytelling, messaging, and education;
- Intergovernmental/intragovernmental coordination; and
- Levels of service and performance targets factoring in climate change impacts and system constraints (asset management project outcomes may address this).

It may seem that providing facts and unbiased information to people would lead them to make decisions in the same way. However, social science experiments have demonstrated that information alone is not the solution. People tend to interpret facts strongly in the direction of their past experiences. Rather than solely providing facts, meeting people where they are, finding common ground, and building partnerships through regular contact and communication is critical.

At the NOAA and the Water Research Foundation workshop in 2020, the organizers noted that engaging neighborhood residents as ambassadors was mutually beneficial. The relationships provided common understanding between City staff, utility staff, and community members and helped connect communities to project funding resources. This community-based approach achieved triple-bottom-line benefits for social, economic, and environmental resilience. The partnerships succeed when:[63]

1. Partners speak a common language. Community members respond when they understand the impact of their behaviors on the environment. Water and climate professionals implement better resilient strategies when they understand community impacts and needs.
2. The utility and the community work together. If community members feel ownership of the project, they take pride in it, which is vital for long-term maintenance.
3. Community members have trusted relationships with the utilities. Relationships are a two-way street: they help planners and engineers understand what the community wants and needs, and they give community members a window into water infrastructure and climate issues—as well as greater awareness of water careers.

Communication and outreach strategies for GSI may include a variety of platforms such as presentations and workshops, media campaigns, websites, written materials, inter-agency partnerships, and/or connections through community-based organizations. When working with minority communities, GSI practitioners should recognize language barriers and plan to produce materials in the language(s) of the target audiences. Other ways to promote accessibility and equity in the community engagement process include providing directions to a location from public transit, including contact information to request accommodations, holding meetings outside of typical working hours, and offering food or childcare. Community pop-up events and joining with pre-existing events (e.g., cultural festivals) can also be an effective means of community engagement and buy-in. Additional information on Communication Strategies for Green Infrastructure is available through the Georgetown Climate Center.

2.6 Limitations of GSI

GSI cannot solve all community climate-related challenges. While local governments are in a good position to promote sustainable stormwater management on a larger scale, they also face complex challenges in implementing and maintaining GSI. Resources are limited, responsibilities are fragmented, and the tolerance for risk is generally low.

Unless GSI is implemented at a watershed scale, it is unlikely that it would be able to completely address receiving water quality impairments. The climate benefits of distributed green street and parcel-based GSI facilities may be overwhelmed by unmitigated existing urban areas.

Similarly, although GSI can assist in mitigating localized flood impacts, GSI facilities that are sized for water quality treatment will become saturated and bypass larger flows, providing minimal flood benefit during large storm events.

GSI requires maintenance to continue to provide water quality and hydrologic benefits. Without a dedicated O&M funding source, GSI facilities may lose their ability to provide climate resilience benefits over time.

Given the existing built environment, a combination of management measures, including GSI and other solutions, will continue to be needed to achieve greater benefits and more resilient communities.

3. POLICY AND REGULATORY REQUIREMENTS

This section summarizes existing policies and regulations relevant to GSI and climate change and discusses the importance of incorporating resilience into future policies and regulations. This section also touches on the role of grants and funding options for infrastructure improvements that prioritize projects in disadvantaged communities and community partnerships.

3.1 Policies and Regulations Concerning GSI and Climate Resilience

In the United States, the Federal Water Pollution Control Act was amended in 1972 to become the Clean Water Act (CWA). The CWA prohibits discharge of pollutants to waters of the United States from any point source unless the discharge complies with a National Pollutant Discharge Elimination (NPDES) permit. A framework for regulating municipal, industrial, and construction stormwater discharges under the NPDES program was amended to the CWA in 1987.[iii] In 1990, USEPA published final requirements for stormwater permits for MS4s[iv] serving a population of over 100,000 (Phase I communities). In 1998, USEPA published final requirements for MS4s serving populations under 100,000 (Phase II communities). Discharges from CSSs, combined sewer overflows (CSOs), are also regulated under NPDES permits.

Through these requirements, owners/operators of MS4s are required to develop, implement, and enforce a stormwater management program that includes post-construction runoff control along with other program areas. The post-construction runoff control program requires control of pollutant loads, volume, and flowrate impacts of stormwater runoff from development. Communities with CSOs must comply with the CSO Control Policy, which requires pollution prevention and other controls.

Climate change resilience has not been substantially amended to these regulations at the federal level. However, some state and local regulations and policies focus on

[iii] under Section 402(p).

[iv] An MS4 is a conveyance or system of conveyances that is: owned by a public entity and discharges to waters of the US; designed or used to collect stormwater; not a combined sewer; and not part of a sewage treatment plant.

resilience and are also relevant to stormwater management. In the United States, for example, the NPDES permit issued in 2022 by the San Francisco Bay Regional Water Quality Control Board requires that permittee's Green Infrastructure Plans are consistent with climate change adaption plans. The permit also requires long-term green infrastructure implementation to consider linkages to climate change impacts and resilience.[64] All permittees must complete a Climate Change Adaption Report by 2026, identifying potential climate change-related assets and appropriate adaptation strategies.

Canada does not have national regulations for stormwater similar to the US NDPES requirements. However, Canadian provinces and cities do have to meet other environmental and infrastructure requirements and goals in a sustainable manner.[65] An example of a local resilience standard in Canada includes the Toronto City Council's adopted Version 4 of the Toronto Green Standard (July 2021). This Standard addresses resilience through, "enhanced green infrastructure to manage stormwater runoff, reduce urban heat island impacts and promote biodiversity (including more extensive and higher performance green roofs), bioswales, rain gardens, native pollinator species plantings and a new requirement for "green streets" (roads or streets that incorporate green infrastructure)."[66] These standards apply to new development applications beginning May 2022.

Complimentary to the growing body of GSI regulations that consider climate change impacts, many state grant programs, and federal infrastructure funding options are focusing on climate resilience related to stormwater projects (for example, California Climate Resilience Package funds).[67] These funding options also emphasize and/or require project implementation in disadvantaged communities.

3.2 Incorporating Resilience into Policies and Regulations

Municipalities and other local agencies may incorporate resilience into local policies and regulations in response to regional, statewide, or federal regulations and/or to protect infrastructure. Climate adaption touches on many municipal departments that might not have a history of working together and that may have competing interests. As such, interagency and interdepartmental coordination and collaboration at various levels of governance are critical for resilience. In addition, broader partnerships and multi-disciplinary collaboration will be needed. More specifically, GSI project implementation increasingly involves the private sector (e.g., developers) and schools, requiring partnerships between landowners with different motivations and requirements. Engaging local communities and addressing equity issues to collaborate and realize a unified vision will also be essential.

Local GSI-related policy and regulatory changes that integrate climate resilience may include:

1. Policy updates, for example:
   - A requirement that the planning, design, and construction of projects and GSI facilities consider and incorporate resilience against climate change impacts for a specified climate change scenario and planning horizon. Such a requirement could require larger sizing of facilities or require specific treatment mechanisms, such as increased retention or detention.
   - For proposed GSI, a requirement to consider climate adaptation, mitigation, equity, and integration with other green or grey infrastructure (e.g., cloudburst management) for greater resilience in planning and implementation.
   - For existing GSI, a requirement to update asset management, operations and maintenance, system modeling, and assumed performance to address changing precipitation patterns, heat, and other climate risks to adequately understand system performance and maintenance needs. Depending on the outcomes of the updates, existing facilities may need to be retrofit or modified to better respond to changing conditions.
   - Flexibility to enable the mixing of private and public stormwater to allow common or regional GSI facilities to benefit from private development contributions and vice versa.
   - Requirements to integrate resilience planning across departments (i.e., stormwater compliance/public works, transportation, urban forestry/parks, climate adaptation planning, local hazard mitigation planning, water supply, sewer, etc.) and align environmental policies on resilience.
2. Updates to ordinances, design guidelines, and standard details and specifications for public and private new and redevelopment GSI, as well as other public infrastructure projects, to consider projected changes in

precipitation patterns, sea-level rise, temperature, and other climate impacts. Such updates could require redundancy through multi-layered grey-green stormwater infrastructure systems for unpredictable volumes and flow rates.

3. Adaptive management of policies and standards to respond to and anticipate changing conditions due to climate change and its environmental impacts and confirm that existing policies do not result in unintended challenges with GSI implementation.

3.3 Next Steps

Additional development of GSI policy guidance in the context of climate resilience could be incorporated into future parts of this Guide. This could include:

1. Methods for conducting risk assessment relating to GSI performance. Specifically, whether GSI can meet future and anticipated regulatory requirements given current implementation practices, including scenario planning to examine a potential range of outcomes.
2. Guidance for policy decision-making including options for addressing uncertainty with respect to climate change impacts to GSI and utilizing the outcomes of GSI risk assessments.
3. Potential management questions to be addressed in policy updates for climate resilient GSI planning and design.
4. Development of model policy language to address opportunities for improving climate resilience in GSI planning and implementation
5. Economic evaluation guidance relevant to GSI, including methods for GSI lifecycle assessments with consideration of different future climate-related standards. Economic/risk evaluation guidance could also consider how benefits from GSI could be incorporated into bond ratings that consider climate resilience.

4. GSI PLANNING

This section explores considerations for GSI planning related to climate resilience and incorporating climate resilience into GSI planning. As equity considerations and community engagement are important throughout the GSI implementation processes, these components are touched on below.

4.1 Considerations for GSI Planning Related to Climate Resilience

GSI planning entails several steps, including site and opportunities assessment, selection of GSI types, initial layout, permitting, and conceptual design. The scale at which GSI planning is conducted can range from a single property, block, neighborhood, or subwatershed to an entire City, County, or region. The full benefits of GSI may be better achieved when these measures are planned at the regional or watershed scale. Regional scale planning may also consider linkages to related municipal water and sewer infrastructure and land management activities aimed at achieving "One Water" outcomes. Public outreach should be included in planning to provide project direction and garner support for planned GSI. GSI siting considerations and objectives that may be considered in planning assessments include those relating to:

- Ease of implementation, such as location, ownership, accessibility, physical and site use/programming constraints.
- Performance considerations, including hydrologic and hydraulic factors and favorable subsurface conditions.
- Potential benefits, including improved water quality, flood management, groundwater recharge, stormwater capture, and reuse, urban greening, equity, and biodiversity.
- Incorporating social data such as identifying disadvantaged and vulnerable communities.
- Funding sources and capital and maintenance costs.
- Cost-effectively complying with applicable regulatory requirements.

Future stormwater regulations may require incorporating resilience into GSI planning, however, even in the absence of specific regulatory drivers, stormwater agencies may want to consider the additional risk climate change impacts pose. Climate resilience should be considered in GSI planning when:

1. Climate change could impact GSI performance, or
2. GSI has the potential to improve community resilience (e.g., providing flood reduction or drought resilience).

Considerations for these separate, but related, GSI planning goals are explored in the sections below.

4.1.1 Potential Impacts of Climate Change on GSI Performance

Projected climatic impact drivers, including changes to snowmelt, larger storm events, higher rainfall intensities, longer duration events, and increased soil moisture, are likely to reduce the effectiveness of GSI facilities[68] by reducing the proportion of runoff volume that may be captured and treated. Climate change may also impact the ability of GSI designed per current guidance to meet or partially meet current water quality or flood control targets. Higher temperatures cause greater stress to vegetation in GSI facilities. Projected sea and lake level rise may impact feasible locations for GSI due to inundation and rising groundwater levels.

Potential changes to or considerations of how GSI planning processes can better incorporate GSI facility resilience could include:

1. Locating GSI where climate change is less likely to impact GSI performance (e.g., avoiding: rising groundwater or surface water levels, areas of increased flood ponding, increased heat and impacts to plants, reduced irrigation water supply, or microclimates in the region observed or projected to have more extreme precipitation or heat).
2. Setting volume-based runoff capture targets to prevent inundation and erosion of GSI facilities. Such targets may differ from or exceed current local regulations.
3. Recommend GSI types and general plant/tree selection considerations with consideration of projected changes to climate.

4.1.2 Opportunities for GSI to Increase Community Resilience

There are a number of opportunities for GSI to increase climate resilience, as described previously in section 2.3. Increased precipitation associated with larger storms under climate futures may have undesirable impacts on roadway and transit infrastructure, especially for vulnerable communities, where multi-scale GSI implementation at a watershed level may provide valuable relief to associated public infrastructure like streets and roads. Climate change may also exacerbate other conditions that GSI is implemented to partially mitigate, such as the urban heat island effect, localized flooding, or impacts on disadvantaged communities. GSI may also become part of the toolbox in thinking more strategically about integrated water planning to address prolonged drought.

Potential changes to or considerations of how GSI planning processes can incorporate climate resilience provided by GSI could include:

1. Locating GSI to more optimally meet anticipated climate-related regulations or policy.
2. Setting volume-based runoff capture targets to target projected localized flooding or water quality concerns, which may differ from or exceed current local regulations.
3. Locating GSI to provide additional climate-related resilience benefits (e.g., localized flooding benefits, urban heat island benefits, water supply benefits, combined park and water storage opportunities, community resilience, and active transportation options).
4. Including social and infrastructure data to understand community climate-related vulnerability, including in underserved communities, identify where climate-related improvements are most needed, and locate GSI where it can address some of these needs.
5. Considering GSI projects across scales to assess potential benefits to the greater green infrastructure and natural heritage system, improving landscape connectivity and system resilience.
6. Recommending GSI types and general plant/tree selection considerations to maximize climate resilience-related benefits in the planning stage.

In addition to the planning considerations above, larger-scale water quality and pollutant loading changes resulting from climate change should be considered. These include but are not limited to:

1. Rising temperatures resulting in increased water temperatures in receiving water bodies; and
2. Increases in eutrophication, especially in shallow water bodies.

GSI facilities or planning strategies previously developed to meet specific water quality goals may require updating as other water quality impacts become evident and/or are included in regulations.

4.2 Incorporating Climate Resilience into GSI Planning

Additional objectives and siting considerations may be needed to incorporate these climate-resilience considerations in the earliest phases of GSI planning and assessment. Incorporating climate resilience considerations into a community's GSI planning may entail stakeholder and municipal interdepartmental meetings to identify and prioritize climate-related objectives. This may also entail additional steps, data, desktop, or field studies when performing GSI opportunity analysis (i.e., identifying locations to implement GSI). Suggested approaches for how to incorporate climate resilience considerations in GSI planning are provided in this section.

Planning and decision-making processes to incorporate climate-resilience considerations into GSI opportunity analyses may entail:

1. Identifying management priorities relating to GSI planning and design in the context of climate resilience, including:
    - Compliance with new regulatory requirements or policies relating to climate change;
    - Implementation or retrofit to achieve more resilient GSI; and
    - Optimization of GSI locations and capacity at a subwatershed scale to maximize resilience-related benefits.
2. Identifying when in the planning process to consider climate resilience, such as:

   - Formation of planning objectives, prioritizing those facilities that can comply with resilience requirements or provide enhanced climate resilience.
   - Developing partnerships with stakeholders and community members to implement GSI for climate resilience goals, including "One Water" type strategies.
   - GSI siting, to account for future potential impacts of climate change (e.g., hydrologic, temperature, and groundwater level changes) on GSI performance.
   - Identification of GSI types, and extent and types of landscape/vegetation and trees, to maximize the resilience benefits provided as well as performance (adapting tree and plant species to changing climate conditions)
   - Integration and coordination with other infrastructure and community plans to incorporate GSI or avoid conflict with other larger-scale climate resilience efforts.
3. Identifying planning-level climate resilience data or projections to consider for GSI implementation, for example:
   - Watershed-level quantitative targets (i.e., reduced flows or volume) for resilience.
   - The range of projected changes to precipitation patterns (e.g., calculated predictions for future floods, design storm frequencies) and potential design changes (as available and appropriate) for successful GSI performance.
   - Location and frequency of minor localized flooding or large flooding events.
   - Changes to groundwater level, including locations and frequency of flooding due to surfacing groundwater.
   - Areas, timing, and duration of urban heat stress.
   - Opportunities for groundwater recharge or capture and reuse.
   - Land use and ownership characteristics that may streamline or hinder GSI implementation or performance.
   - Relevant equity indicators.

- Community goals, concerns, and priorities for GSI and climate resilience.

4.3 Next Steps

Additional development of GSI planning guidance in the context of climate resilience could be incorporated into future parts of this Guide. This could include:

1. Guidance on decision-making processes to establish community climate resilience priorities for GSI, including:
    - Compiling regulatory requirements and how they may be achieved through GSI.
    - Establishing a comprehensive list of multi-benefit objectives.
    - Identifying relevant stakeholders and performing outreach.
    - Developing cost-benefit analyses relating to GSI and climate resilience.
    - Planning in response to adjusted requirements or design standards that consider climate change.
2. Guidance on suggested data, indicators, and metrics to locate and prioritize GSI, for example:
    - Identifying data needs relating to GSI and climate resilience (such as projected temperature changes, projected precipitation changes, flood modeling output, water quality data and/or modeling output, etc.).
    - Developing benefit metric increments that could be used to identify whether a specific location and type of GSI could provide climate resilience.
    - Description of the geospatial, other modeling, and calculation methods that could be used to analyze benefit metrics and drive implementation targets.
3. Guidance on geospatial processes to locate GSI opportunities:
    - Listing GSI opportunity analysis data needs in the context of climate resilience, such as land use, ownership, physical properties including soil, depth to groundwater, utility conflicts, etc.
    - Describing logic-based geospatial analyses to identify beneficial GSI candidate sites and remove less-favorable opportunity locations.

- Planning frameworks that address uncertainty (e.g., Robust Decision Making).

4. Guidance on incorporating needs and priorities of disadvantaged communities, identifying successful approaches for community engagement, and encouraging the equitable implementation of GSI to achieve long-term success in the context of a changing climate.
5. Developing an evaluation framework to prioritize project opportunities to robustly capture considerations related to environmental performance, climate change risk, and social vulnerabilities and benefits.

5. GSI DESIGN

Several climatic impact drivers related to GSI are projected to change in the future and would likely affect GSI design. These drivers include precipitation, including changing storm event characteristics such as the size, intensity, duration, and location of significant rain events,[69] along with flood and submergence from rising sea, riverine, and groundwater levels and extreme temperature. Impacts are anticipated at different scales, and while there is a need for adaptation at the facility, project, and sub-watershed scale, the section below focuses on GSI design at the facility scale. This section introduces the established approach (i.e., that is currently in use) for GSI siting, sizing, and design, describes climate-related considerations that may be needed, and suggestions on how to incorporate changes to GSI siting, sizing, and design approaches given climate trends.

5.1 Established Conceptual Model for GSI Siting, Sizing, and Design

Following the adoption of federal requirements for stormwater management in the 1980s, researchers published findings on how post-construction stormwater volumes and loads could be appropriately controlled. The results of an early study by Schueler[70] were widely adopted by regulatory agencies and used in subsequent technical guidance. That study recommended that stormwater best management practices (BMPs) should be sited and designed to 1) reproduce the hydrologic conditions of the downstream receiving water; 2) provide a moderate level of removal for most urban pollutants; and 3) have a neutral impact on the natural and human environment.[71]

Many of these early studies focused on a general class of stormwater BMPs, including detention and non-biological filtration type facilities. Conventional detention-type stormwater BMPs capture stormwater from large storm events and release it over time to reduce runoff intensity. The use of low impact development (LID) and GSI was promulgated under subsequent NPDES stormwater permits in the late 2000s and early 2010s. LID requirements focused on mimicking a wider range of natural hydrologic functions beyond runoff discharge, including rainfall interception, shallow surface storage, evapotranspiration, and infiltration/ groundwater recharge.[72]

LID technical guidance focused on siting GSI and other stormwater management facilities by considering physical constraints, including underlying soil or geotechnical characteristics, slope, depth to groundwater, proximity to wells or infrastructure, and anticipated pollutant loading into the BMP. Physical siting characteristics that increase the potential volume that can be retained by the facility (i.e., infiltration, capture and use, and evapotranspiration) were also incorporated.

5.1.1 Stormwater Facility Sizing

For many locations and depending on the regulatory agency, sizing requirements for total runoff captured for conventional stormwater facilities and GSI have remained unchanged for the past two decades. GSI technical guidance also recommends maximizing the retention of captured stormwater.

When examining the percent of total average annual runoff captured and treated as a function of BMP size, a "knee of the curve" is evident for most sites. This change in the instantaneous slope of the curve represents the point at which increases in BMP size (and cost) yield diminishing returns in total runoff captured and treatment effectiveness. For example, in California, the "knee of the curve" occurs at approximately the 75^{th}-85^{th} percentile storm event, corresponding to approximately 80% of average annual stormwater runoff (Figure 2). When a flow-based facility is designed to capture a larger rainfall intensity, a similar "knee of the curve" is found (e.g., 0.1 – 0.25 inches per hour in California).[73] This pronounced knee of the curve for both volume and flow-based sizing approaches allows for GSI cost efficiency while providing sufficient stormwater capture to reduce runoff volumes and pollutant loads in downstream receiving waters.

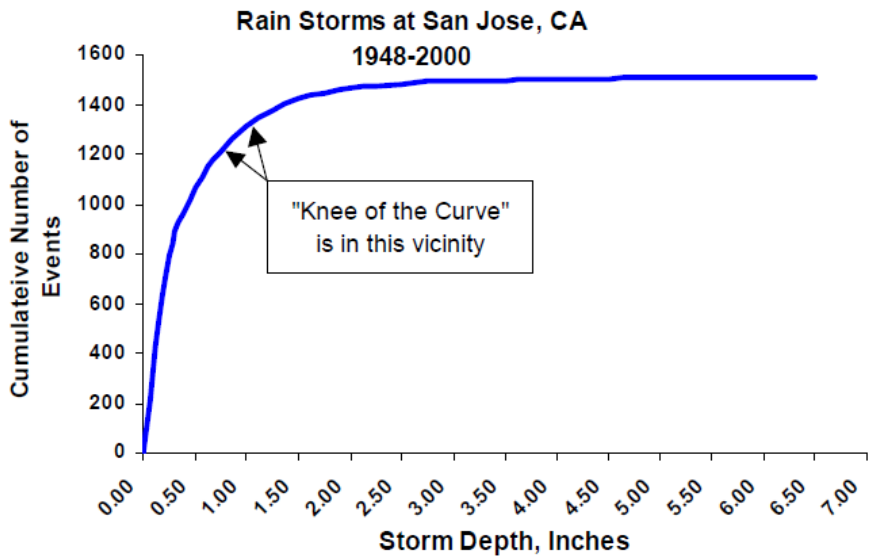


Figure 2. Example "Knee of the Curve" based on Historical Data[74]

5.1.2 GSI Component Design

Technical studies of early GSI applications resulted in recommendations for typical GSI components. These components include GSI media, vegetation, and hydraulic elements (i.e., inlets, outlets, and underdrain).

Media

Following several studies identifying reduced infiltration of GSI facilities over time, media mixes were studied to identify how to avoid a decrease in performance. These studies identified that a fast filtration rate through the media (e.g., a minimum of 5 inches per hour in the San Francisco Bay Area) was required to prevent clogging. Faster drawdown of stored volume was also thought to prevent vector issues.

To provide these very fast infiltration rates, the proportion of clay in the media mix (for example, present in native topsoil used as a component) had to be greatly minimized or removed. Many regions adopted media mixes that were heavily sand-based and would therefore drain very quickly. This has resulted in benefits with reducing clogging potential but has resulted in other issues relating to plant health and irrigation requirements that are likely to be exacerbated with rising temperatures. This is particularly relevant for locations expecting to see increasing frequency, duration, and intensity of drought conditions.

Vegetation
Healthy vegetation is a key component of GSI performance. Plants provide biological treatment of pollutants, help maintain infiltration, and increase evapotranspiration. Given the harsh conditions in GSI facilities (i.e., episodic periods of submergence and desiccation), site-specific and more resilient plant palettes are needed

Hydraulic Elements
GSI technical manuals often recommend that facilities be designed to be "off-line" or installed such that only a portion of the total runoff is diverted to the facility. This avoids impacts of erosion and extended submerged periods that may occur otherwise. Inlets, underdrains, and outlets (including orifice-controlled outlets) are frequently sized to capture the required historic flow volume to meet water quality requirements.

5.2 Considerations for GSI Related to Climate Resilience

While the impacts on GSI are expected to vary by region, location, and type of facility, larger storm events, higher rainfall intensities, longer duration events, and more saturated initial conditions are likely to reduce the effectiveness of GSI facilities.[75] Other climate change impacts, including rising groundwater and changes in temperature, may also affect GSI siting and performance.

5.2.1 Hydrologic Impacts: Precipitation Change and Early Snowmelt

Design standards are typically developed based on multiple decades of historical precipitation data. GSI facilities are currently designed with the implicit assumption that past rainfall-runoff patterns will persist over their design life. Since climate change is anticipated to alter historic rainfall-runoff patterns, facilities may be in jeopardy of underperforming in the future. Climate change is projected and has already been observed to affect precipitation patterns. Rainfall is becoming more intense in many locations and less frequent in others. When the proportion of smaller, low-intensity events and larger, high-intensity events is altered, the amount of total stormwater runoff captured by a GSI facility may change. When this results in a smaller overall amount of runoff captured, the facility may no longer provide the hydrologic or water quality benefits it was designed to provide. In addition, the "knee of the curve" may be entirely shifted or become less pronounced. In the future, it may not be appropriate to preclude larger facility sizes for providing diminishing returns.

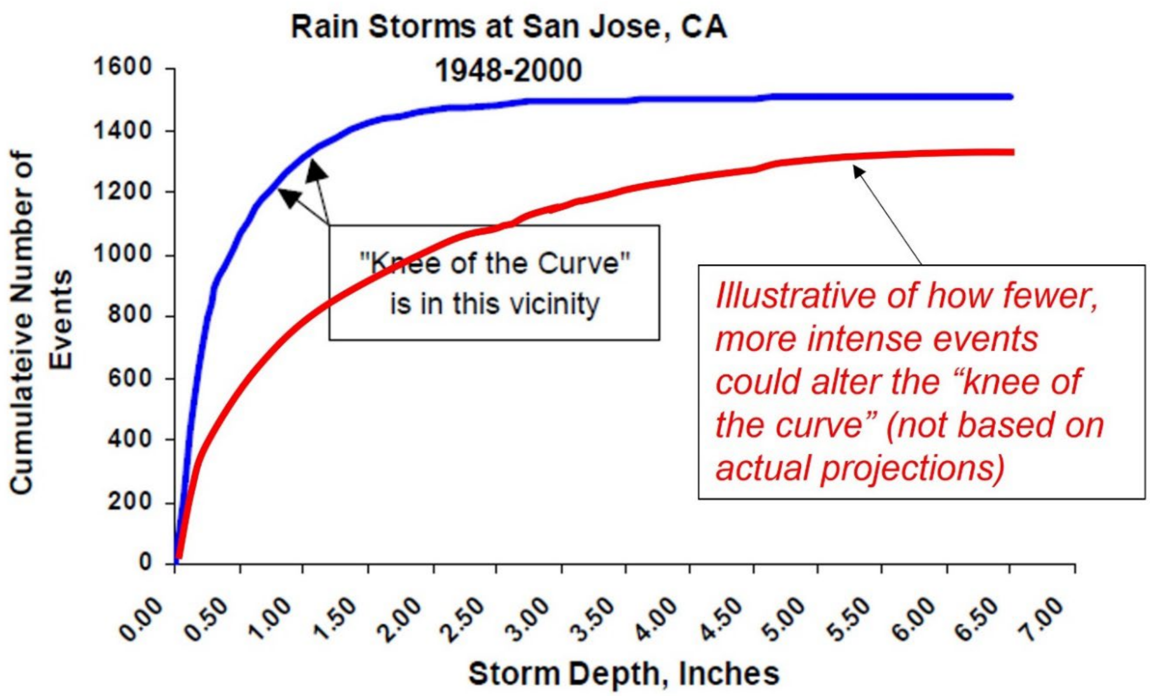


Figure 3. Altered "knee of the curve" sketch due to climate change impacts.

Based on modeling results from downscaled Global Climate Models[v] (GCMs) and hourly precipitation developed through an application of regional weather modeling for Western Washington, Figure 4 provides an actual example of an altered "knee of the curve."[76]

[v] Global Climate Models (GCMs) are a representation of the major climate system components - atmosphere, land, ocean, and sea ice – and their interactions. They are used for forecasting climate change.

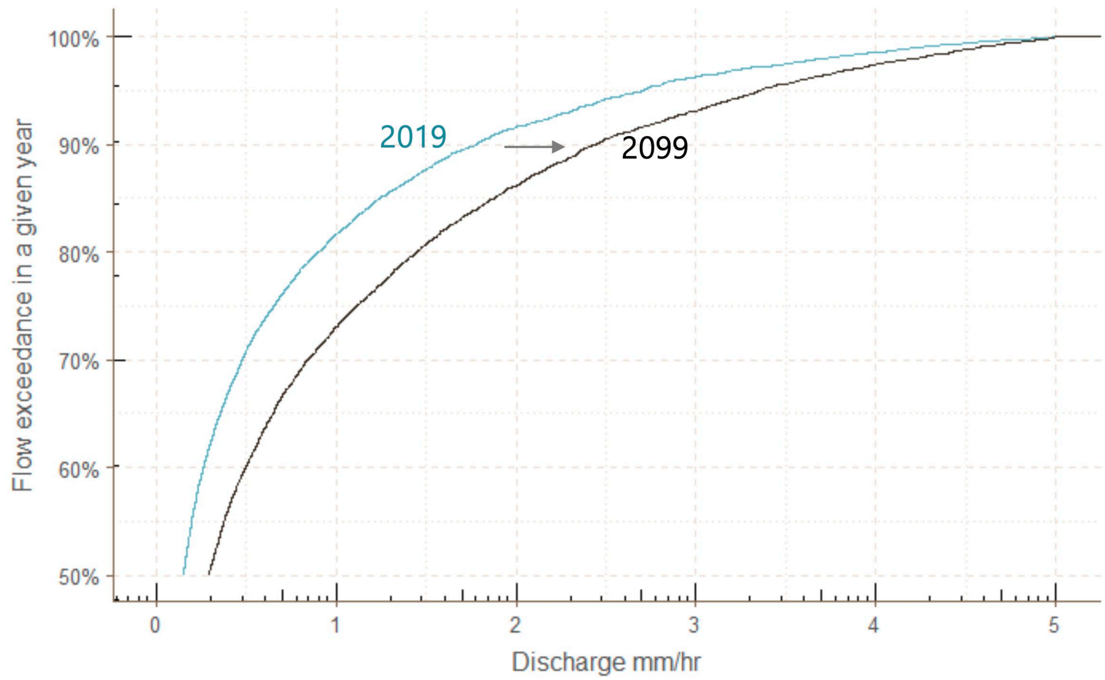


Figure 4. Actual altered "knee of the curve" due to climate change impacts in Western Washington.

In addition, more intense, less frequent storm events and other precipitation changes could affect facility performance. For example, an increased frequency of intense "back-to-back" winter storm events and atmospheric rivers has been observed in the western United States, while the eastern United States has seen an overall increase in very heavy precipitation (defined as the top one percent of all daily events) (Figure 5).

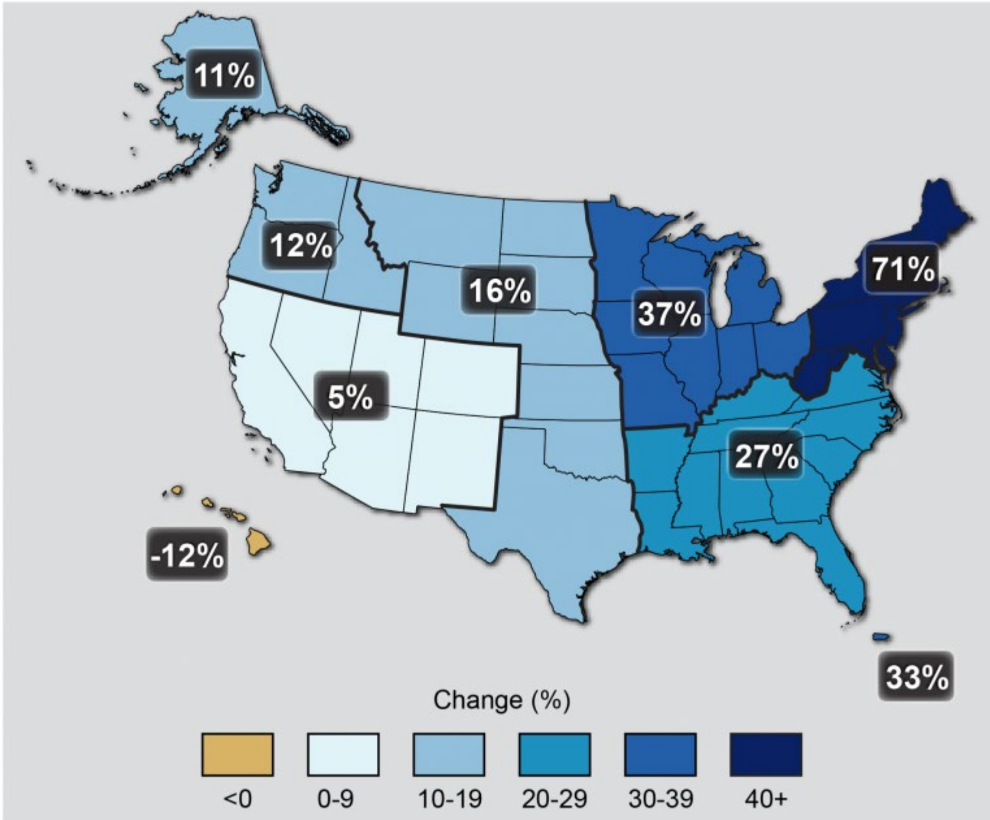


Figure 5. Map of the observed change in very heavy precipitation (defined as the top 1% of all daily events) from 1958 to 2012[77] in the U.S.

Beyond increased runoff from precipitation, conditions within the GSI facility itself may be impacted. When more storms occur in a shorter time, the ability of the GSI facility to drain, dry out, and capture the next storm is diminished, and runoff capture performance is reduced as systems bypass increased or cumulative flow.

Communities with CSSs may see an increase in CSOs or combined sewer discharges (CSDs) with increased large storm events. The performance of GSI implemented to provide upstream retention and detention may be impacted and result in impacts to the downstream POTW.

Seasonal precipitation changes, such as an extended dry season or longer dry periods between storms, may result in reduced water quality performance. These changes, which have already been observed in some locations, may cause an increase in pollutant accumulation on the landscape. Higher concentrations of pollutants in seasonal first-flush events could impact GSI facility performance and may require additional pretreatment to maintain performance.

5.2.2 Other Impacts: Temperature and Sea Level Rise

Temperature changes may affect the performance of specific GSI design components. Some researchers have argued that increased temperature associated with climate change may lead to better performance of GSI due to reduced water viscosity and increased infiltration,[78] though temperature differences related to GSI performance vary by facility type with bioinfiltration showing more sensitivity than pervious pavement.[79] Media mixes with a high proportion of sand may dry out too quickly to maintain vegetative health when temperatures are higher. Vegetation that may have thrived in lower temperature fast-draining facilities may be increasingly stressed under higher temperatures.

Subsurface changes should also be considered for resilient GSI. Groundwater levels may rise due to increased nearby lake and sea levels. As sea levels rise, the risk of saltwater intrusion increases. As a result, areas with relatively shallow groundwater that were once suitable for GSI may no longer be appropriate.

Groundwater level rise near freshwater lakes like Lake Ontario may also cause periodic sustained inundation of the root zones of GSI facilities, causing potential rotting of roots and plant failure. More resilient species selection and grading design will need to be incorporated to anticipate these potential climate impacts.

5.3 Incorporating Climate Resilience into GSI Sizing and Design

The challenges described suggest the need for an updated approach to sizing and designing resilient GSI. Details of how climate resilience could be incorporated into GSI sizing and design are introduced in this section.

5.3.1 GSI Sizing

As described, hydrologic changes may necessitate updated GSI facility sizing guidance. This could include “dynamic sizing” approaches that more fully consider facility drawdown processes, as well as considerations of projected changes to local precipitation patterns.

Precipitation projections from Global Climate Models (GCMs) may be used in place of historic rainfall observations to design GSI facilities appropriately. However, most GCMs do not have an adequate spatial or temporal scale needed to represent urban stormwater. Most GCMs operate on a daily timestep, whereas urban storm events occur in minutes or hours. Several regions have begun to develop spatially and temporally downscaled models to provide refined precipitation datasets for stormwater managers. Local universities or state resources have often developed regionally downscaled models and identified GCMs that better represent their region. These downscaled models typically use GCM results as inputs to a regional weather forecasting model to provide more detail. The resulting precipitation data sets have a finer spatial and temporal resolution (e.g., 1-hour vs. 1-day).

While GCMs provide reliable results on a continental scale, they often suffer from both transient and system biases when compared to observed rainfall. Therefore, downscaled model outputs usually need to undergo bias correction before they can be used for planning. Additionally, regions with highly variable microclimates may require additional spatial downscaling or interpretation to be effectively used for facility sizing.

Selection of GCMs

GCMs are run for a historical period (hindcasting) and a future period (forecasting). Using the historical period, practitioners can compare GCM results with observed precipitation in the region. Different GCMs will vary in their potential applicability to a specific region. GCMs that perform poorly for the region, as tested by local researchers, universities, or state agencies, can be excluded.

Selection of Emissions Scenarios

The IPCC regularly selects and updates Representative Concentration Pathways (RCPs), reflecting the range of plausible future emissions scenarios (Table 4). Climate change predicted under higher RCPs is typically more severe, although precipitation impacts do not always scale with increased warming.

Table 4. Summary of IPCC Emission Scenarios (adapted from IPCC AR5, 2014[80])

<table>
<tr><th rowspan="2">Scenario</th><th rowspan="2">CO_2-eq Concentrations in 2100 (ppm)</th><th colspan="2">Change in CO_2-eq emissions compared to 2010 (in %)</th><th colspan="4">Likelihood of temperature change relative to 1850-1900 remaining below:</th></tr>
<tr><th>2050</th><th>2100</th><th>+1.5°C</th><th>+2°C</th><th>+3°C</th><th>+4°C</th></tr>
<tr><td>RCP2.6</td><td>430 – 480</td><td>-72 to -41</td><td>-118 to -78</td><td>More unlikely than likely</td><td>Likely</td><td rowspan="2">Likely</td><td rowspan="3">Likely</td></tr>
<tr><td>RCP4.5</td><td>580 - 720</td><td>-38 to 24</td><td>-134 to -50</td><td rowspan="3">Unlikely</td><td>More likely than not</td></tr>
<tr><td>RCP6.0</td><td>720 - 1000</td><td>18 to 54</td><td>-7 to 72</td><td rowspan="2">Unlikely</td><td>More unlikely than likely</td></tr>
<tr><td>RCP8.5</td><td>> 1000</td><td>52 to 95</td><td>74 to 178</td><td>Unlikely</td><td>More unlikely than likely</td></tr>
</table>

Although each RCP varies with respect to atmospheric carbon and long-term warming effects, climate change models suggest similar surface warming over the next 30-40 years (Figure 6). This period is equal to the design life of most GSI facilities. Therefore, projects implemented in this decade (i.e., the 2020s) can expect similar results regardless of the specific RCP.

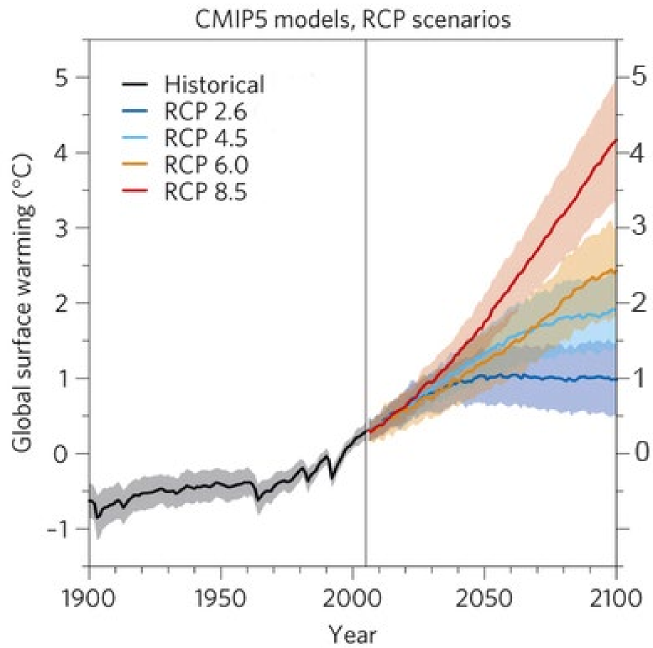


Figure 6. Projected global surface warming for different emissions scenarios[81]

The selected RCP scenario will have a more significant impact on projects with a longer design life or implemented in the second half of the 21st century. Considerations of risk and uncertainty should drive the selection of an RCP. For example, the highest emissions scenario, RCP 8.5, represents a more conservative analysis than lower emissions scenarios. Multiple RCPs may be chosen for a study to bracket the range of possible outcomes. If multiple scenarios are evaluated, they should be treated as independent outcomes and should not be aggregated or averaged.

5.3.2 GSI Types

In addition to standard GSI performance changing for a range of different precipitation outcomes, different GSI types may perform better or worse depending on regional climate trends. Guidance for identifying the GSI types or combinations (including with other types of stormwater management approaches) that provide increased climate resilience would be a valuable tool for communities.

Single GSI facilities that rely on fixed detention storage, for example, may fare worse than facilities that incorporate multiple treatment mechanisms (i.e., retention, infiltration, soil storage, evapotranspiration), especially in regionally wet/cool and wet/warm climates where rainfall intensity, duration and frequency may be more dynamic or increase over time. In many regions, regardless of trends in heat and precipitation, multiple GSI facility types used together in a 'treatment-train' may provide more resilience than single facilities. Other potential options to increase GSI resilience to climate change impacts include using real-time control, adjustable outlet structures, stormwater capture and use, and GSI implemented with other large-scale nature-based solutions or cloudburst-type facilities.

5.3.3 GSI Hydraulic Components

Changes to the design and sizing of inlet, outlet, and overflow components may also be needed to adapt GSI facilities to climate change. As the hydrologic regime shifts, an inlet design that previously captured sufficient volume and flow may no longer do so. Similarly, if a facility must be designed to capture more intense or larger storms, underdrain sizing, outlet sizing, and overflow operations may also need to be revisited. Analyzing inlet, underdrain, and outlet performance with projected climate change can provide insight into potential design changes.

5.3.4 Media and Vegetation Considerations

Other GSI design components, such as media, vegetation, subsurface, liners, and structural elements may be affected by climate change and require additional design changes.

For example, media amendments (e.g., biochar) that encourage water retention while maintaining drawdown rates may be needed to sustain plant health as temperatures increase. Plant and tree species selection will need to adapt to more site-specific plant palettes that survive in harsh (including extreme dry and submerged) conditions in anticipation of rising temperatures and changing precipitation patterns, as well as potential changes in groundwater levels. Approved species lists by municipalities will need to take into consideration how climate change will affect plant hardiness zones. The shifting of those zones over time (projected by the US Forest Service)[82] with rising temperatures and increased precipitation will need to be taken into account when designing vegetated systems to last many decades into the future.

In nearshore locations with shallow groundwater, future groundwater levels should be considered. These considerations will affect the design of a facility as well as specific features (e.g., whether a GSI facility should incorporate an impermeable liner). Additional considerations include selecting appropriate plant palettes under future climate change and selecting appropriate media. Facility grades and hydrozone can be evaluated for optimizing plant health and selecting specific species for unique GSI configurations (i.e., stormwater planters with deeper uniform media vs. rain gardens with variable surface grades and elevations related to different hydrozones).

5.3.5 Additional Considerations for CSO Communities

CSO communities may require additional analysis to estimate the amount of upstream GSI-provided retention (e.g., infiltration) and detention needed to offset anticipated future runoff volume. The siting of upstream GSI and the volume provided may require adjustment to adequately prevent overflows given changing climate conditions.

5.3.6 GSI Facility Retrofit

The performance of existing GSI facilities may decline because of impacts of climate change. Declining performance could include but not be limited to:

1. Capture of a smaller proportion of average annual runoff or a smaller total volume, resulting in increased occurrence of bypass and less proportional or total treatment.
2. Erosion impacts to GSI facility surface or hydraulic components.
3. Other hydraulic issues such as extended ponding or flooding near inlet, outlet, or overflow with resultant vector issues.
4. Subsurface impacts, including groundwater intrusion into facility or export of pollutants to sensitive underlying groundwater basins; and/or
5. Poor vegetation survival.

Existing facilities may require re-analysis and retrofit of hydraulic components, installing a facility liner, replacing vegetation with better-suited species, enlarging facilities, or building additional facilities upstream or downstream.

5.4 Next Steps

Additional development of GSI design guidance in the context of climate resilience could be incorporated into future parts of this Guide. Potential future guidance topics are provided below.

5.4.1 Quantifying the Potential Extent of Climate Impacts to GSI

GSI design and retrofit changes needed for resilience can be further studied by examining the potential to mitigate the impacts of climate change and the extent of impacts on GSI facility performance. Comparing predicted future climate conditions to historical conditions and/or modeling GSI using a range of these conditions should be examined first. This analysis can provide insight into how the performance of existing GSI or GSI designed per current practices may be impacted.

GCMs could be identified for specific metropolitan areas, and their output could be examined for different RCPs compared to historical conditions (e.g., temperature and precipitation). Clear trends or changes identified through this comparison would provide high-level insight into potential GSI performance challenges. Developing more detailed GSI models incorporating regionally downscaled models would also provide more precise estimates of potential GSI performance issues.

5.4.2 Resilience of GSI Measures and Components

Using the results of the analysis described in section 5.4.1, or through literature studies, guidance could be developed to inform which designs or GSI measures are most resilient to anticipated climate changes. This could include a tool, such as a matrix or a flowchart, which identifies GSI measures and design changes (e.g., media amendments, facility liner, constructing facility off-line, etc.) that are best suited to manage specific climate impacts. This guidance could also be used as a planning tool once developed.

5.4.3 Methods to Develop New GSI Design Standards or Guidance

A technical and/or decision-making methodology for identifying the changes needed for GSI volume or hydraulic design could be developed. The proposed method would incorporate the range of estimated GSI performance changes leveraging existing tools at the local or regional level. This would result in the GSI sizing factors or guidance that appropriately accounted for observed or projected changes in near-term precipitation and projected precipitation compared to long-term historic precipitation.

Additional analysis could be conducted to develop methods for changing existing design guidance for GSI components, including but not limited to:

1. Consideration of standards governing facility drawdown time and developing a method to examine potential impacts to drawdown with climate change.
2. Modeling analysis or methods to examine facility hydraulics (e.g., filtration rate, discharge rate) and associated performance changes for a range of drawdown times corresponding to different precipitation regime changes.
3. Developing factors or design changes to be incorporated into hydraulic components of facilities to address GSI performance modeling outcomes.
4. Quantifying uncertainty in design inputs.
5. Updating GSI plant palettes and resilient plant selection methods for different regions and their anticipated environmental changes. This could include guidance on hydrozone-specific plant placement geared towards specific GSI facility types to optimize vegetation health and facility resilience.

6. GSI OPERATIONS AND MAINTENANCE

This sections outlines considerations for GSI operations and maintenance (O&M) related to climate resilience and incorporating climate resilience into GSI O&M. Several climate impact drivers, including changes to temperature, precipitation, flood, rising sea, riverine, and groundwater levels, and changes to snow patterns could impact O&M.

6.1 Considerations for GSI Operations and Maintenance Related to Climate Resilience

Typical operations and maintenance (O&M) practices for GSI include routine and non-routine actions specific to each facility type. Examples of GSI O&M practices and their frequency include:

1. Frequent O&M needs: irrigation, plant maintenance, trash removal.
2. Post-storm O&M needs: Inspections to examine damage including erosion, standing water/drawdown issues, and needed rehabilitation.
3. Annual O&M needs: mulch replacement, clean out of hydraulic components (inlet, outlet, or underdrain), addressing fine sediment accumulation.
4. Infrequent O&M needs: scarification of the top layer of media, plant replacement, replacement of hydraulic or structural components, replacement of media/mulch.

Typical GSI O&M practices and frequency may require adjustment to maintain performance under future climate change. Potential changes to these activities could include:

1. Frequent O&M needs: more frequent, longer term, or higher volume of irrigation or more frequent plant maintenance needs due to higher temperatures and/or changing precipitation patterns.
2. Post-storm O&M needs: More frequent inspections or rehabilitation (e.g., increased erosion caused by higher intensity storms).
3. Annual O&M needs: deeper or more frequent mulch application, increased frequency of sediment removal, and maintenance of hydraulic components to account for increased erosion and flooding.

4. Infrequent O&M needs: Plant or plant palette replacement due to drought conditions; retrofit/replacement of hydraulic components; replacement of media to provide adjusted/needed filtration or drawdown rate.

In addition to the typical O&M practices listed, the impact of changes to regular maintenance practices of nearby infrastructure should be considered. This could include, for example, increased or different amounts of salt applied to adjacent roadways in response to snow and ice changes, or increased irrigation applied to adjacent landscaping in response to increased temperature. These adjacent O&M practices could generate runoff that may impact GSI facilities; responsive GSI O&M needs should be considered.

6.2 Incorporating Resilience into GSI O&M

To incorporate resilience into GSI, O&M programs should adapt as needed to keep pace with anticipated climate change, recognizing that severe impacts are often unpredictable and will occur more frequently.

6.2.1 Climate Change Education & Training

A critical component for adapting GSI O&M programs includes communication, education, and training of GSI maintenance staff and personnel. Staff should be made aware of policy changes relating to GSI and potential changes to GSI performance based on scientific studies or community-specific analysis. Staff communication should be bidirectional and encourage the reporting of anecdotal evidence or observations of potential climate-related impacts on GSI facilities. A communication plan including education and training of staff, along with obtaining input from staff, should be developed to support and inform adaptive management of O&M practices.

Community involvement can also be considered in the O&M phase. While some O&M tasks would require work by trained professionals (e.g., replacement of soil media or structural components), the local community and residents could do other tasks, such as plant maintenance and trash removal. This type of community buy-in would improve the potential for long-term success.

6.2.2 Adaptive Management

Adaptive management processes may require more frequent inspections to learn how enhanced O&M affects GSI performance. Over time, visual inspection data coupled with precipitation and temperature data could be used to examine trends in GSI performance with specific O&M practices; changes to those trends would indicate that updates to an O&M program are needed. Results from such an evaluation would be useful to identify staff or contractor training needs, tools, and resulting funding requirements. In addition, increasing temperatures may affect the health of maintenance staff, requiring schedule adjustments. A key component to adaptive management is a robust asset management strategy that can efficiently and consistently capture O&M-related data. Changes to asset management with consideration of climate resilience may also be needed.

6.3 Next Steps

Additional development of GSI O&M guidance in the context of climate resilience could be incorporated into future parts of this Guide. This could include:

1. Providing guidance on an education, training, and communication strategy that supports adaptive management of GSI O&M practices.
2. Developing a stepwise process for examining current maintenance practices and estimating the potential required changes with projected climate impacts. In addition to examining individual activities, the stepwise approach could include suggestions for exploring staffing, tools, and cost impacts.
3. Identifying key components of asset management tools that may require update to adequately track climate trends and impacts (e.g., better linkage with preceding storm size, geospatial data needs, plant health rating scales, etc.).

7. CLIMATE RESILIENCE RESOURCES GUIDE ROAD MAP – SUGGESTED NEXT STEPS

This Guide explores the intersection of GSI and climate change. It describes how GSI that is thoughtfully planned, designed, and implemented can be important for increasing resilience to climate risks, and climate change adaptation in the urban environment at a "broad brush level" and for a variety of future climate change impacts anticipated throughout North America. GSI is part of the range of solutions that can help manage urban flooding, erosion, and urban island heat impacts, and can also improve air quality, provide water supply augmentation, and provide ecosystem and human health benefits. Equitable implementation of GSI is more critical than ever, as vulnerable communities will feel climate change impacts first and worst, and GSI is often implemented when it is easy but not where it is needed most. Community engagement early and often, combined with meeting residents in their local communities, will improve the chances of long-term success.

GSI facilities are also vulnerable to climate change impacts. This Guide provides technical resources and considerations for improving the resilience of GSI planning, design, and implementation in the face of various climate change risks.

This Guide and its appendix of GSI-related climate resilience references are intended to be living documents for the GI Leadership Exchange to leverage for current use and to build from for future GSI program development as the science and community around resilience and GSI continues to evolve. Topics to consider for future additions to this Guide are outlined and prioritized below in Table 5.

Table 5. Prioritized Topics for Future Iterations of this Guide

Section	Next Step
Policy and Regulations	Methods for conducting risk assessment and scenario planning.
	Guidance for policy decision-making with uncertainty.
	Potential management questions in climate-resilient planning and design.
	Model policy language for climate resilience relating to GSI.
	Economic evaluation guidance relating to GSI.
GSI Planning	Guidance on decision-making processes to establish climate resilience priorities and goals, including community benefits and equity.
	Guidance on suggested data, indicators, and metrics to locate and prioritize GSI, as well as select GSI type.
	Guidance on geospatial processes to site GSI.
	Evaluation framework to prioritize project opportunities.
GSI Design	Quantifying the potential extent of climate impacts to GSI.
	Flowchart or tool to guide which designs or GSI measures are most resilient to anticipated climate changes.
	Methods to develop new GSI design standards or guidance.
GSI O&M	GSI O&M communication, education, and training strategy.
	Process to estimate potential required changes to maintenance activities, staffing, tools, and cost impacts.
	GSI O&M asset management guidance.

8. SOURCES CITED

[1] United States Environmental Protection Agency (USEPA). 2022. Why You Should Consider Green Stormwater Infrastructure for Your Community. Accessed on 15 April 2022. https://www.epa.gov/G3/why-you-should-consider-green-stormwater-infrastructure-your-community

[2] Center for Neighborhood Technology (CNT). 2010. The Value of Green Infrastructure. A Guide to Recognizing Its Economic, Environmental and Social Benefits. Accessed 18 April 2022. https://cnt.org/publications/the-value-of-green-infrastructure-a-guide-to-recognizing-its-economic-environmental-and

[3] CNT. 2010.

[4] USEPA. 2022.

[5] National Oceanic and Atmospheric Administration (NOAA) Fisheries. 2022. Understanding Living Shorelines. https://www.fisheries.noaa.gov/insight/understanding-living-shorelines

[6] Leatherman, S.P., K. Zhang, and B.C. Douglas. 2000. Sea level rise shown to drive coastal erosion. Eos, 81(6), 55–57. https://doi.org/10.1029/00EO00034/ABSTRACT

[7] New York City Department of Environmental Protection. 2017. Cloudburst Resiliency Planning Study, Executive Summary. Prepared by Ramboll A/S. January.

[8] Intergovernmental Panel on Climate Change (IPCC). 2021. Annex VII: Glossary [Matthews, J.B.R., V. Möller, R. van Diemen, J.S. Fuglestvedt, V. Masson-Delmotte, C. Méndez, S. Semenov, A. Reisinger (eds.)]. In Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 2215–2256, doi:10.1017/9781009157896.022.

[9] IPCC. 2021.

[10] IPCC. 2021.

[11] Arias, P.A., N. Bellouin, E. Coppola, R.G. Jones, G. Krinner, J. Marotzke, V. Naik, M.D. Palmer, G.-K. Plattner, J. Rogelj, M. Rojas, J. Sillmann, T. Storelvmo, P.W. Thorne, B. Trewin, K. Achuta Rao, B. Adhikary, R.P. Allan, K. Armour, G. Bala, R. Barimalala, S. Berger, J.G. Canadell, C. Cassou, A. Cherchi, W. Collins, W.D. Collins, S.L. Connors, S. Corti, F. Cruz, F.J. Dentener, C. Dereczynski, A. Di Luca, A. Diongue Niang, F.J. Doblas-Reyes, A. Dosio, H. Douville, F. Engelbrecht, V. Eyring, E. Fischer, P. Forster, B. Fox-Kemper, J.S. Fuglestvedt, J.C. Fyfe, N.P. Gillett, L. Goldfarb, I. Gorodetskaya, J.M. Gutierrez, R. Hamdi, E. Hawkins, H.T. Hewitt, P. Hope, A.S. Islam, C. Jones, D.S. Kaufman, R.E. Kopp, Y. Kosaka, J. Kossin, S. Krakovska, J.-Y. Lee, J. Li, T. Mauritsen, T.K. Maycock, M. Meinshausen, S.-K. Min, P.M.S. Monteiro, T. Ngo-Duc, F. Otto, I. Pinto, A. Pirani, K. Raghavan, R. Ranasinghe, A.C. Ruane, L. Ruiz, J.-B. Sallée, B.H. Samset, S. Sathyendranath, S.I.

Seneviratne, A.A. Sörensson, S. Szopa, I. Takayabu, A.-M. Tréguier, B. van den Hurk, R. Vautard, K. von Schuckmann, S. Zaehle, X. Zhang, and K. Zickfeld. 2021. Technical Summary. In Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 33−144. doi:10.1017/9781009157896.002.

[12] Arias et al. 2021.

[13] National Research Council. 2010. Adapting to the Impacts Of Climate Change. Washington, DC: The National Academies Press. https://doi.org/10.17226/12783

[14] Jantarasami, L., R. Novak, R. Delgado, C. Narducci, E. Marino, S. McNeeley, J. Raymond-Yakoubian, L. Singletary, and K. Powys Whyte. 2018. Chapter 15 : Tribal and Indigenous Communities. Impacts, Risks, and Adaptation in the United States: The Fourth National Climate Assessment, Volume II. https://doi.org/10.7930/NCA4.2018.CH15

[15] Norton-Smith, K., K. Lynn, K. Chief, K. Cozzetto, J. Donatuto, M. Hiza Redsteer, L.E. Kruger, J. Maldonado, C. Viles, and K.P. Whyte. 2016. Climate change and indigenous peoples: a synthesis of current impacts and experiences. https://doi.org/10.2737/PNW-GTR-944

[16] Roth, M. 2018. A resilient community is one that includes and protects everyone. Bulletin of the Atomic Scientists, 74(2), 91–94. https://doi.org/10.1080/00963402.2018.1436808

[17] Gutierrez, K., and C. LePrevost. 2016. Climate Justice in Rural Southeastern United States: A Review of Climate Change Impacts and Effects on Human Health. International Journal of Environmental Research and Public Health, 13(2), 189. https://doi.org/10.3390/ijerph13020189

[18] Gutierrez and LePrevost. 2016.

[19] Anderson, A.S., A.E. Reside, J.J. VanDerWal, L.P. Shoo, R.G. Pearson, and S.E. Williams. 2012. Immigrants and refugees: the importance of dispersal in mediating biotic attrition under climate change. Global Change Biology, 18(7), 2126–2134. https://doi.org/10.1111/j.1365-2486.2012.02683.x

[20] Crozier, L.G., and J.A. Hutchings. 2014. Plastic and evolutionary responses to climate change in fish. Evolutionary Applications, 7(1), 68–87. https://doi.org/10.1111/eva.12135

[21] Franks, S.J., J.J. Weber, and S.N. Aitken. 2014. Evolutionary and plastic responses to climate change in terrestrial plant populations. Evolutionary Applications, 7(1), 123–139. https://doi.org/10.1111/eva.12112

[22] Hoffmann, A.A., and C.M. Sgrò. 2011. Climate change and evolutionary adaptation. Nature, 470(7335), 479–485. https://doi.org/10.1038/nature09670

[23] Pinsky, M.L., B. Worm, M.J. Fogarty, J.L. Sarmiento, and S.A. Levin. 2013. Marine Taxa Track Local Climate Velocities. Science, 341(6151), 1239–1242. https://doi.org/10.1126/science.1239352

[24] Thomas, A.C., A.J. Pershing, K.D. Friedland, J.A. Nye, K.E. Mills, M.A. Alexander, N.R. Record, R. Weatherbee, and M.E. Henderson. 2017. Seasonal trends and phenology shifts in sea surface temperature on the North American northeastern continental shelf. Elementa: Science of the Anthropocene, 5. https://doi.org/10.1525/elementa.240

[25] Mellin, C., M. Lurgi, S. Matthews, M.A. MacNeil, M.J. Caley, N. Bax, R. Przeslawski, and D.A. Fordham. 2016. Forecasting marine invasions under climate change: Biotic interactions and demographic processes matter. Biological Conservation, 204, 459–467. https://doi.org/10.1016/j.biocon.2016.11.008

[26] Román-Palacios, C., and J.J. Wiens. 2020. Recent responses to climate change reveal the drivers of species extinction and survival. Proceedings of the National Academy of Sciences, 117(8), 4211–4217. https://doi.org/10.1073/pnas.1913007117

[27] Rizwan, A.M., L.Y.C. Dennis, and C. Liu. 2008. A review on the generation, determination and mitigation of Urban Heat Island. Journal of Environmental Sciences, 20(1), 120–128. https://doi.org/10.1016/S1001-0742(08)60019-4

[28] Hibbard, K.A., F.M. Hoffman, D. Huntzinger, and T.O. West. 2017. Ch. 10: Changes in Land Cover and Terrestrial Biogeochemistry. Climate Science Special Report: Fourth National Climate Assessment, Volume I. https://doi.org/10.7930/J0416V6X

[29] Wehner, M.F., J.R. Arnold, T. Knutson, K.E. Kunkel, and A.N. LeGrande. 2017. Ch. 8: Droughts, Floods, and Wildfires. Climate Science Special Report: Fourth National Climate Assessment, Volume I. https://doi.org/10.7930/J0CJ8BNN

[30] National Oceanic and Atmospheric Administration (NOAA). 2022. U.S. Climate Resilience Toolkit. https://toolkit.climate.gov/

[31] Shafique, M., and K. Reeho. 2017. Green stormwater infrastructure with low impact development concept: a review of current research. https://doi.org/10.5004/dwt.2017.20981

[32] USEPA. 2022.

[33] Johnson, D., J. Exl, and S. Geisendorf. 2021. The Potential of Stormwater Management in Addressing the Urban Heat Island Effect: An Economic Valuation. https://doi.org/10.3390/su13168685

[34] Zölch, T., J. Maderspacher, C. Wamsler, and S. Pauleit. 2016. Using green infrastructure for urban climate-proofing: An evaluation of heat mitigation measures at the micro-scale. Urban Forestry & Urban Greening, 20, 305–316. https://doi.org/10.1016/J.UFUG.2016.09.011

[35] Johnson et al. 2021.

[36] Hunter Block, A., S.J. Livesley, and N.S.G. Williams. 2012. Responding to the urban heat island: a review of the potential of green infrastructure. https://www.semanticscholar.org/paper/Responding-to-the-urban-heat-island%3A-a-review-of-of-Block-Livesley/c9307c609b485e4c148564a17fa697a9920c54c1

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[37] Hewitt, C.N., K. Ashworth, and A.R. Mackenzie. 2020. Using green infrastructure to improve urban air quality (GI4AQ). Ambio, 49. https://doi.org/10.1007/s13280-019-01164-3

[38] Neft, I., M. Scungio, N. Culver, and S. Singh. 2016. Simulations of aerosol filtration by vegetation: Validation of existing models with available lab data and application to near-roadway scenario. Aerosol Science and Technology, 50(9), 937–946. https://doi.org/10.1080/02786826.2016.1206653/SUPPL_FILE/UAST_A_1206653_SM3755.ZIP

[39] Hewitt et al. 2020.

[40] Natural Resources Defense Council. 2009. Water Efficiency Saves Energy: Reducing Global Warming Pollution Through Water Use Strategies. www.nrdc.org/policy

[41] National Academies. 2019. Beneficial Use of Graywater and Stormwater An Assessment of Risks Costs and Benefits | National Academies. https://www.nationalacademies.org/our-work/beneficial-use-of-graywater-and-stormwater-an-assessment-of-risks-costs-and-benefits

[42] City of South San Francisco and Lotus Water. 2021. Orange Memorial Park Storm Water Capture Project. Proceedings of "CASQA Stormwater Capture and Use: Making it Happen" Meeting. 15 April.

[43] Suppakittpaisarn, P., X. Jiang, and W.C. Sullivan. 2017. Green Infrastructure, Green Stormwater Infrastructure, and Human Health: A Review. Current Landscape Ecology Reports, 2(4), 96–110. https://doi.org/10.1007/s40823-017-0028-y

[44] Green Schoolyards America. 2022. Accessed on 21 June 2022. https://www.greenschoolyards.org/

[45] Suppakittpaisam et al. 2017.

[46] Kuo, L.E., M. Czarnecka, J.B. Kitlinska, J.U. Tilan, R. Kvetansk, and Z. Zukowska. 2008. Chronic Stress, Combined with a High-Fat/High-Sugar Diet, Shifts Sympathetic Signaling toward Neuropeptide Y and Leads to Obesity and the Metabolic Syndrome. Annals of the New York Academy of Sciences, 1148(1), 232–237. https://doi.org/10.1196/annals.1410.035

[47] Nutsford, D., A.L. Pearson, and S. Kingham. 2013. An ecological study investigating the association between access to urban green space and mental health. Public Health, 127(11), 1005–1011. https://doi.org/10.1016/J.PUHE.2013.08.016

[48] Taylor, M.S., B.W. Wheeler, M.P. White, T. Economou, and N.J. Osborne. 2015. Research note: Urban street tree density and antidepressant prescription rates—A cross-sectional study in London, UK. Landscape and Urban Planning, 136, 174–179. https://doi.org/10.1016/J.LANDURBPLAN.2014.12.005

[49] Troy, A., J. Morgan Grove, and J. O'Neil-Dunne. 2012. The relationship between tree canopy and crime rates across an urban–rural gradient in the greater Baltimore region. Landscape and Urban Planning, 106(3), 262–270. https://doi.org/10.1016/J.LANDURBPLAN.2012.03.010

[50] Kaplan, R., and S. Kaplan. 1989. The Experience of Nature A Psychological Perspective.

[51] Kondo, M.C., S.C. Low, J. Henning, and C.C. Branas. 2015. The impact of green stormwater infrastructure installation on surrounding health and safety. American Journal of Public Health, 105(3), e114–e121. https://doi.org/10.2105/AJPH.2014.302314

[52] Lee, K.E., K.J.H. Williams, L.D. Sargent, N.S.G. Williams, and K.A. Johnson. 2015. 40-second green roof views sustain attention: The role of micro-breaks in attention restoration. Journal of Environmental Psychology, 42, 182–189. https://doi.org/10.1016/J.JENVP.2015.04.003

[53] City of Philadelphia, Office of Sustainability. 2021. Philadelphia Climate Action Playbook. January. Accessed 8 March 2022. https://www. phila.gov/media/20210113125627/Philadelphia-Climate-Action-Playbook.pdf

[54] McDonald, R.I., T. Biswas, C. Sachar, I. Housman, T.M. Boucher, D. Balk, D. Nowak, E. Spotswood, C.K. Stanley, and S. Leyk. 2021. The tree cover and temperature disparity in US urbanized areas: Quantifying the association with income across 5,723 communities. PLoS One Apr 28, 16(4): e0249715. https://doi.org/10.1371/journal.pone.0249715

[55] McDonald et al. 2021.

[56] Roth. 2018.

[57] City/County Association of Governments (C/CAG) of San Mateo County and Caltrans. 2021. San Mateo Countywide Sustainable Streets Master Plan. January. Accessed 27 January 2022. https://ccag.ca.gov/countywide-sustainable-streets-master-plan/

[58] Green Infrastructure Leadership Exchange and Greenprint Partners. 2022. Equity Guide for Green Stormwater Infrastructure Practitioners. March. Accessed on 8 April 2022. https://giexchange.org/wp-content/uploads/2022/03/Equity-Guide-for-GSI-Practioners_March-2022-1.pdf

[59] Green Infrastructure Leadership Exchange and Greenprint Partners. 2022.

[60] National Oceanic and Atmospheric Administration and the Water Research Foundation. 2020. "Filling in the Gaps: Climate and Weather Information for Small and Medium-Size Water Utilities." NOAA Workshop Series. Accessed on 31 January 2022. https://cpo.noaa.gov/Divisions-Programs/Climate-and-Societal-Interactions/Water-Resources/Water-Utility-Study

[61] United State. Water Alliance. 2017. An Equitable Water Future, A National Briefing Paper. Accessed 8 April 2022. http://uswateralliance.org/sites/uswateralliance.org/files/publications/uswa_water-equity_FINAL.pdf

[62] Green Infrastructure Leadership Exchange and Greenprint Partners. 2022.

[63] National Oceanic and Atmospheric Administration and the Water Research Foundation. 2020.

[64] California Regional Water Quality Control Board, San Francisco Bay Region. 2022. Municipal Regional Stormwater NPDES Permit. Order No. R2-2022-0018. NPDES Permit No. CAS612008. 11 May. https://www.waterboards.ca.gov/rwqcb2/water_issues/programs/stormwater/MRP/mrp5-22/R2-2022-0018.pdf

[65] Sustainable Property. 2016. New Solutions for Sustainable Stormwater Management in Canada, Report. September. https://institute.smartprosperity.ca/ sites/default/files/stormwaterreport.pdf

[66] City of Toronto. 2021. Toronto Green Standard Version 4 Adopted by Toronto City Council. Issued 30 July. https://www.toronto.ca/wp-content/uploads/2021/08/8d47-CityPlanningTGSNotice v4.pdf

[67] State of California. 2021. Governor Newsom Signs Climate Action Bills, Outlines Historic $15 Billion Package to Tackle the Climate Crisis and Protect Vulnerable Communities. Office of Governor Gavin Newsom. 23 September. https://www.gov.ca.gov/2021/09/23/governor-newsom-signs-climate-action-bills-outlines-historic-15-billion-package-to-tackle-the-climate-crisis-and-protect-vulnerable-communities/

[68] Jackisch, N., and M. Weiler. 2017. The hydrologic outcome of a Low Impact Development (LID) site including superposition with streamflow peaks. Urban Water Journal, 14(2), 143–159. https://doi.org/10.1080/1573062X.2015.1080735

[69] Sohn, W., J.H. Kim, M.H. Li, and R. Brown. 2019. The influence of climate on the effectiveness of low impact development: A systematic review. In Journal of Environmental Management (Vol. 236). https://doi.org/10.1016/j.jenvman.2018.11.041

[70] Schueler, T.R. 1987. Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs. Department of Environmental Programs, Metropolitan Washington Council of Governments. July.

[71] Schueler. 1987.

[72] County of Los Angeles Department of Public Works. 2014. Low Impact Development: Standards Manual. February. https://dpw.lacounty.gov/ldd/lddservices/docs/Low_Impact_Development_Standards_Manual.pdf

[73] California Association of Stormwater Quality Agencies (CASQA). 2003. Stormwater Best Management Practice Handbook - New Development and Redevelopment. January. Accessed 27 January 2022. https://www.casqa.org/sites/default/files/BMPHandbooks/BMP_NewDevRedev_Complete .pdf

[74] CASQA. 2003.

[75] Jackisch and Weiler. 2017.

[76] Nilsen, C. 2020. How climate change may influence stormwater runoff: Insights from the Puget Sound Stormwater Heatmap. Presentation. 10 September. https://github.com/cnilsen/nebc-conference-2020/blob/55b70e7fa6eff3c1b51d8b031eda4d2964f8a663/Nilsen_NEBC_Stormwater_2020_out.pdf

[77] Walsh, J., D. Wuebbles, K. Hayhoe, J. Kossin, K. Kunkel, G. Stephens, P. Thorne, R. Vose, M. Wehner, J. Willis, D. Anderson, S. Doney, R. Feely, P. Hennon, V. Kharin, T. Knutson, F. Landerer, T. Lenton, J. Kennedy, and R. Somerville, 2014: Ch. 2: Our Changing Climate. Climate Change

Impacts in the United States: The Third National Climate Assessment, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 19-67. doi:10.7930/J0KW5CXT. Figure 2-18. https://nca2014.globalchange.gov/report/our-changing-climate/heavy-downpours-increasing#graphic-16693

[78] Lewellyn, C., C.E. Lyons, R.G. Traver, and B.M. Wadzuk. 2016. Evaluation of Seasonal and Large Storm Runoff Volume Capture of an Infiltration Green Infrastructure System. Journal of Hydrologic Engineering, 21(1), 04015047. https://doi.org/10.1061/(ASCE)HE.1943-5584.0001257

[79] Emerson, C.H., and R.G. Traver. 2008. Multiyear and Seasonal Variation of Infiltration from Storm-Water Best Management Practices. Journal of Irrigation and Drainage Engineering, 134(5), 598–605. https://doi.org/10.1061/(ASCE)0733-9437(2008)134:5(598)

[80] Adapted from IPCC. 2014. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland. 151 pp.

[81] IPCC. 2014.

[82] United States Department of Agriculture. n.d. Shifts in Growing Degree Days, Plant Hardiness Zones and Heat Zones. https://www.climatehubs.usda.gov/hubs/northern-forests/topic/shifts-growing-degree-days-plant-hardiness-zones-and-heat-zones

APPENDIX A
Matrix of Existing GSI Resilience Resources

Matrix 1. State of the Science: Resources Exploring the Intersection of Green Stormwater Infrastructure and Climate Change

Title	Year	Author(s)	Resource Type	Priority Item (1 to 5)	Green Stormwater Infrastructure		Climate Change Impact								Focus on Equity	Web Link	Brief Summary
					Mention of GSI	Focus on GSI	Urban Heat	Precip	Snow-fall	Sea Level/ Lake/ Riverine Rise	Water Stress	Bio-diversity	Tree/ Green Equity	Air Quality			
Milwaukee Metropolitan Sewerage District: Regional Infrastructure Plan	2013	Milwaukee Metropolitan Sewerage District	Plan	2	X	X		X			X			X		https://www.mmsd.com/what-we-do/green-infrastructure/resources/regional-green-infrastructure-plan	Milwaukee's green infrastructure plan; The "Green Infrastructure Benefits and Costs" section detailed the triple-bottom-line analysis (sustainable development).
San Mateo Countywide Sustainable Streets Master Plan	2021	C/CAG & Caltrans	Plan	2	X	X		X								https://ccag.ca.gov/countywide-sustainable-streets-master-plan/	General guideline on sustainable streets for San Mateo County.
EPA: Green Infrastructure for Climate Resiliency	2021	EPA	Website	2	X	X	X	X		X	X	X				https://www.epa.gov/green-infrastructure/green-infrastructure-climate-resiliency	General information how GSI can help build climate resiliency.
Philadelphia Water Department: Green City Clean Waters	2011	Philadelphia Water Department	Plan	2	X		X	X		X	X	X		X		https://water.phila.gov/green-city/	Philadelphia's Green City Clean Waters program, a 25-year plan to reduce the volume of stormwater entering combined sewers using green infrastructure and to expand stormwater treatment capacity with traditional infrastructure improvements.
City of Portland and Multnomah County Climate Action Plan	2015	City of Portland / Multnomah County	Plan	2	X		X	X	X							https://www.portland.gov/bps/climate-action/history-and-key-documents#toc-resiliency-and-preparation	Portland's climate action plan
Green Infrastructure and Climate Change Collaborating to Improve Community Resiliency	2016	EPA / Office of Watewater Management	Report	2	X	X	X	X			X					https://www.epa.gov/sites/default/files/2016-08/documents/gi_climate_charrettes_final_	EPA convened charrettes, or intensive planning sessions in Albuquerque, Grand Rapids, Los Angeles, and New Orleans, to explore the ways in which green infrastructure could help cities become more resilient to climate change. Four different case studies are shown.
Reducing Damage from Localized Flodding - A Guide for Communities (FEMA)	2005	FEMA	Guide	2	X	X		X								https://www.fema.gov/pdf/fima/FEMA511-complete.pdf	FEMA's guide on reducing damage from localized flooding. GSI is suggested throughout the guide.
Developing the evidence base for mainstreaming adaptation of stormwater systems to climate change	2012	Gersonius et al.	Journal Article	3, 4, 5	X												The study introduced the mainstreaming method that can help enhance the understanding of the adaptive potential of stormwater systems.
Incorporating climate change into culvert design in Washington State, USA	2017	Wilhere et al.	Journal Article	3	X												Test culvert designs based on potential climate change impacts.
Flood loss avoidance benefits of green infrastructure for stormwater management	2015	Atkins & EPA	Report	2,3,4	X	X		X								https://www.epa.gov/green-infrastructure/flood-loss-avoidance-benefits-green-infrastructure-stormwater-management	This study generated an estimate of the monetary value of flood loss avoidance that could be achieved by using GSI; FEMA flood loss estimation model Hazus.
Economic assessment of green infrastructure strageties for climate change adaptation: Pilot studies in the Great Lakes Region	2014	Eastern Research Grou, Inc & NOAA	Report	2,3,4	X	X		X								https://coast.noaa.gov/data/digitalcoast/pdf/climate-change-adaptation-pilot.pdf	The purpose of this study was to assess the economic benefits of green infrastructure (GI) as a method of reducing the negative effects of flooding in Duluth, Minnesota, and Toledo, Ohio. A secondary purpose of the study was to develop an analytical framework that can be applied in other communities to 1) consider and estimate predicted changes in future precipitation, 2) assess how their community may be impacted by flooding with increased precipitation, 3) consider the range of available green infrastructure and land use policy options to reduce flooding, and 4) identify the benefits (as well as co-benefits) that can be realized by implementing GI.
Arid green infrastructure for water control and conservation; State of the science and research needs for arid/semi-arid regions	2016	EPA	Report	2	X	X					X					Arid Green Infrastructure for Water Control and Conservation State of the Science and Research Needs for Arid/Semi-Arid Regions | Science Inventory | US EPA	BMPs in arid and semi-arid regions; Policy initiatives and guidance to address drought and water sustainability through green infrastructure; current research in the application of GSI in arid and semi-arid regions.
The value of green infrastructure for urban climate adaptation	2011	The Center for Clean Air Policy	Report	2	X	X	X	X			X					Green Infrastructure FINAL (savetherain.us)	This report showed how each type of green infrastructure can help combat certain climate change impacts. It also suggested strageties for implementing each GI.
Smart Policies for a Changing Climate: The Report and Recommendations of the ASLA Blue Ribbon Pannel on Climate Change and Resilience	2018	American Society of Landscape Architects	Report	2, 4	X										X		The report provides design and planning solutions together with policy recommendations for five different areas (natural systems, community development, vulnerable communities, transportaion, and agriculture) that are important to building climate resilient community.
Green Infrastructure for Climate Resiliency	2014	EPA / Office of Water	Brochure	1, 2	X	X	X	X		X	X						The brochure summarizes the climate change effects on cities and how GSI can help prepare cities to be resilient against flooding, drought, coastal damage and erosion, energy consumption, and urban heat island effect.
An Equity Review of the City of Calgary's Climate Resilience Strategy	2021	Toronto Environmental	Report	2									X		X		Equity-focused review of the Calgary Resilience Strategy: Mitigation and Adaptation Action Plans and provide support to the city as it undertakes an update of this strategy.
Climate Change and Stormwater in Portland, Gresham, and Clackamas County	2021	UW Climate Impacts Group	Report		X			X									The purpose of this project was to develop projections of 21st century changes in precipitation that can be used to inform stormwater and wastewater management in the cities of Portland, Gresham, and Clackamas County. Use global circulation models to predict future precipitation.
BES Resiliency Master Plan and Climate Change Planning for CIP Projects	2017	Jennifer Belknap Williamson; Bureau of Environmental Services	Workshop	2	X		X	X									The pdf is a presentation on the resiliency master plan and climate change planning for CIP projects in Portland.
The Effects of Climate Change on Lake Tahoe in the 21st Centry: Meteorology, Hydrology, Loading and Lake Response	2010	Tahoe Environmental Science Center	Report		X			X								-	The study examines the potential effects of changing meteorologic conditions (future air temp, amount and type of precipitation, stream discharge, sediment and nutrient loading characteristics, BMP performance, lake mixing and water quality response) using existing water resource models developed for the Lake Tahoe TMDL.
An Enhanced Climate-Related Risks and Opportunities Framework and Guidebook for Water Utilities Preparing for a Changing Climate	2021	Water Utility Climate Alliance	Report	2, 3, 4, 5	X												This is a supplement to the "Mapping Climate-related Risks and Opportunities to Water Utility Business Functions Framework" intended for water utility business function leads to use as they begin to assess the climate-related risk and opportunities associated with their critical business functions.
Re-imagining design storm criteria for the challenges of the 21st century	2020	Markolf et al.	Journal Article	3	X	X		X									This paper seeks to idenfity design practices and strategies that are well-suited for the increasingly complex and rapidly changing contexts (climate change and increasing complexity of our urban systems) in which our cities and infrastructure are operating. As the conclusion, at the scale of single components/sub-systems, return periods (or similar criteria) will likely remain a necessary element of the design process. At the scale of entire system(s), approaches like safe-to-fail, robust decision making, and enhanced sensing and simulation amight be more suitable.

Matrix 1. State of the Science: Resources Exploring the Intersection of Green Stormwater Infrastructure and Climate Change

Title	Year	Author(s)	Resource Type	Priority Item (1 to 5)	Green Stormwater Infrastructure		Climate Change Impact								Focus on Equity	Web Link	Brief Summary
					Mention of GSI	Focus on GSI	Urban Heat	Precip	Snow-fall	Sea Level/ Lake/ Riverine Rise	Water Stress	Bio-diversity	Tree/ Green Equity	Air Quality			
Is green infrastructure a viable strategy for managing urban surface water flooding?	2020	Webber et al.	Journal Article	2	X	X		X									This paper seeks to understand the effectiveness of GI on intervene surface water flooding. As the result, intensive application of GI could substantially reduce flood depth and velocity in the catchment but that residual risk remains, particularly during extreme flood events. The best performing intervention strategy in the study area was found to be catchment-wide decentralized rainwater capture.
Making Nature's City: A science-based framework for building urban biodiversity	2019	San Francisco Estuary Institute	Report	5	X	X						X					The report synthesizes global research to develop a science-based approach for supporting nature in cities. It identifies seven key elements of urban form and function that work together to maximize biodiversity. The elements are shown through a case study in Silicon Valley.
What is the role of GSI in managing extreme precipitation events?	2020	McPhillips et al.	Journal Article	2, 3, 4	X	X		X									This paper reviewed GSI design storm requirments for the seven Urban Resilience to Extremes Sustainability Research Network cities in the United States (Atlanta, Baltimore, Miami, New York, Phoenix, Portland, Syracuse). The results indicate that GSI in most of the study cities are designed for smaller, more common precipitation events (1-year storm) considered by current wate rquality regulations. For GSI to contribute to climate change adaptation, it is critical to ensure that design guidelines align with that goal.
NOAA workshop series on improving climate and weather information delivery for small- to medium-size water systems to help build climate resilience (includes 4 resources: brochure, workshop, project summary and appendices)	2020	NOAA	Workshop	3, 4, 5				X	X		X		X		X		This workshop series aim to improve the delivery of climate and weather information resources for small- to medium- size water systems with the goal of building their resilience to climate change. It has a specific section about equity.
Building Urban Stormwater Resiliency by Incorporating Global Climate Change Projections to Local Runoff Modeling	2021	CASQA/2ndNature	Workshop	3	X	X		X								Building Urban Stormwater Resiliency by Incorporating Global Climate Change Projections to Local Runoff Modeling | CASQA - California Stormwater Quality Association	This presentation illustrates the process of incorporating climate change projections to a stormwater model designed for direct use by stormwater managers to inform GSI implementation planning and design.
The tree cover and temperature disparity in US urbanized areas: Quantifying the association with increme across 5,723 communities	2021	McDonald et al.	Journal Article	2	X								X		X		In 92% of the urbanized areas surveyed, low-income blocks have less tree cover than high-income blocks. On average, low-income blocks have 15.2% less tree cover and are 1.5C hotter than high-income blocks.
Simulated sensitivity of urban green infrastructure practices to climate change	2018	Sarkar et al.	Journal Article	2, 3	X	X		X			X	X					This paper used the Regional Hydro-Ecologic Simulation System (a hydrologic and biogeochemical watershed model) to investigate sensitivity of different GI practices to climate changes.
Life cycle assessment of stormwater management in the context of climate change adaptation	2016	Brudler et al.	Journal Article	2, 3	X	X		X									Compared a stormwater management system (combined GSI and local retention measures with planned stormwater routing) with a traditional, sub-surface approach through life cycle assessment. Showed that the adaption plan has lower impacts than the traditional alternative.
Multiobjective optimization of low impact development stormwater controls	2018	Eckart et al.	Journal Article	4, 5	X	X											This paper introduces a coupled optimization-simulation model that links SWMM to the Borg Multi-Objective Evolutionary Algorithm. The coupled model is used to identify the optimal combination of LID controls.
Assessment of low impact development for managing stormwater with changing precipitation due to climate change	2011	Pyke et al.	Journal Article	2	X	X		X									This study considers the potential effectiveness of LID for reducing stormwater impacts on surface water under changing precipitation patterns. Results suggests LID help increasing resilience of communities to changing precipitation patterns.
Potential climate change impacts on green infrastructure vegetation	2016	Catalano de Sousa et al.	Journal Article	2	X	X		X			X						This study investigates the impacts of successive simulated droughts and floods on two plant species commonly installed in green infrastructure sites built in the urban NE USA.
Using rainfall measures to evaluate hydrologic performance of green infrastructure systems under climate change	2021	Cook et al.	Journal Article	2,3	X	X		X									The study suggests that performance of GSI under climage changes can be tracked by using annual rainfall measures (e.g. max daily rainfall per year).
Planning, Designing, Operating, and Maintaining Local Infrastructure in a Changing Climate (includes 4 resources: toolkit, project overview, presentation, and guide)	2021	Baltimore Metropolitan Council & Baltimore Regional Transportation Board	Report & Toolkit	2, 5	X			X		X							Resource guide for departments of public works and transportation in the Baltimore region on potential future climate changes impacts and adaptation strategies and toolkits.
Colma Creek Hydrology and Hydraulic Modeling Analysis	2021	Paradigm Environmental & Northwest Hydraulic Consultants	Report	3, 4, 5	X	X		X		X							The report summarizes the results of hydraulic models of Colma Creek (SF Bay Area) under future climate conditions. Climate change causes higher intensity storms and increases flood risk. GI can mitigate the effects of smaller, more frequent storm events. Current 100-year storm with sea level rise also presents a major risk.
Is Green Infrastructure a Universal Good?	2022	Cary Institute of Ecosystem Studies / Urban Systems Lab	Website	2	X	X							X		X	GI Equity	This project aims to examine the equity of green infrastructure in the urban planning process. The major findings state that over 90% of city plans seek to rearrange the values and hazards of urban landscapes affecting the distributional equity of GI. However, only one in four city plans discusses equity issues. Very few cities acknowledge the potential negative impacts of uneven or disproportionate investment in greening, like green gentrification.
State of Equity Practice in Public Sector: Green Stormwater Infrastructure	2021	The Green Infrastructure Leadership Exchange	Report	2	X	X							X		X	https://giexchange.org/wp-content/uploads/2022/01/State-of-Equity-in-Public-Sector-GSI-Baseline-Report-FINAL.pdf	This report aims to help better understand the extent to which GSI leaders in the public sector are incorporating equity best practices into their work.
Communities and Utilities Partnering for Water Resilience	2022	EPA	Website	3, 4, 5	X											Communities and Utilities Partnering for Water Resilience | US EPA	EPA website on building water resilience in general.
Climate Change and Water Tools	2022	EPA	Toolkit	3, 4, 5	X											Climate Change and Water Tools | US EPA	EPA website on tools for building resilient water utilities including general adaptation strategy guide, maps, and case studies.
Build Flood Resilience at Your Water Utility	2022	EPA	Toolkit	3, 4,5				X			X					Build Flood Resilience at Your Water Utility | US EPA	EPA website on providing tools for building flood resilience.
WaterNow Alliance: Tap Into Resilience	2022	WaterNow Alliance	Website	3, 4, 5	X											Tap into Resilience | from WaterNow Alliance	WaterNow Alliance's initiative on providing water leaders nationwide with tools and inspiration to scale investment in sustainable, localized water infrastructure.
Georgetown Climate Center Green Infrastructure Toolkit	2022	Georgetown Climate Center	Toolkit	2, 3	X	X		X					X		X	Green Infrastructure Toolkit » About This Toolkit - Georgetown Climate Center	Toolkit from Georgetown Law on Green infrastructure planning

Matrix 1. State of the Science: Resources Exploring the Intersection of Green Stormwater Infrastructure and Climate Change

Title	Year	Author(s)	Resource Type	Priority Item (1 to 5)	Green Stormwater Infrastructure		Climate Change Impact								Focus on Equity	Web Link	Brief Summary
					Mention of GSI	Focus on GSI	Urban Heat	Precip	Snow-fall	Sea Level/ Lake/ Riverine Rise	Water Stress	Bio-diversity	Tree/ Green Equity	Air Quality			
Climate Resiliency Design Guidelines	2020	NYC Mayor's Office of Resiliency	Guide	3,4,5	X		X	X		X							The guide provides potential future climate outlook for NYC and provides toolkits to help assess and plan for resilient designs.
Water Utility Resilience Program	2021	State of Massachusetts	Program	3, 4, 5							X					Water Utility Resilience Program | Mass.gov	This program aim at helping water and wastewater utilities to identify helpful and practical resiliency resources, finding opportunities for local and regional partnerships, offering infrastructure mapping and adaptation planning assistance, and coordinating training opportunities. It also provides various tools.
Coastal Flood Resilience Design Guidelines	2019	Boston planning and development agency	Guide	4	X		X	X		X						Boston Planning and Development Agency Releases Coastal Flood Resilience Design Guidelines – NorthEndWaterfront.com	This guide aims to raise awareness of future coastal flood risk, offer strategies to reduce damage and disruption, and provide consistent standards for review of projects that fall within the proposed zoning overlay district.
Climate Resilient Neighborhood of Østerbro	2022	The City of Copenhagen	Website		X			X								Klimakvarter Østerbro	Case study of Copenhagen's first climate resilient neighborhood
Dynamic Adaptive Policy Pathways	2016	Deltares	Website	3, 4, 5												Dynamic Adaptive Policy Pathways - Adaptation Pathways Deltares Public Wiki	The webpage explains the dynamic adaptive policy pathways approach, which aims to support the development of an adaptive plan that is able to deal with conditions of deep uncertainties.
Climate adaptation app	-	Bosch Slabbers, Deltares, Sweco, KNMI, Witteveen+Bos, Climate Changes spatial planning	Website		X			X			X					Adaptive Solutions (climateapp.nl)	The app gives urban designers, engineers or others insight in feasible measrues for a project with a specific climate adaptation goal. The app will generate a selection of feasible climate adaptation measures in less than a minute. If for instance, an urban development in a flood plain is to be prepared for river flooding, the app will rank feasible measures based on the local conditions and the user's input. The user guide can be found here.
Green Cities: Good Health	2010	Urban Forestry / Urban Greening Research	Program		X							X	a			Introduction :: Green Cities: Good Health (washington.edu)	The program support research in the area of showing how nature benefits the human health and well-being in the urbanized areas.
Water Utility Climate Alliance (WUCA) website	2022	Water Utility Climate Alliance	Website	2, 3, 4	X		X	X		X	X					https://www.wucaonline.org/	Website full of resources especially in relation to actionable science, e.g. climate change projections etc. See Plans and Publications and items under work plan, and Case Studies section as well
Advancing Stormwater Resiliency in Maryland (A-StoRM) Maryland's Stormwater Management Climate Change Action Plan	2021	Maryland Department of the Environment	Report	3, 4, 5	X	X		X								https://mde.maryland.gov/Documents/A-StorRMreport.pdf	The report proposes consideration of regulatory changes to include the use of the most recent NOAA Atlas 14 precipitation estimates in Maryland's Stormwater Design Manual and to develop draft updates to Maryland's stormwater design standards for ESD to MEP to capture increased stormwater runoff volume (e.g., 3.0 inches for the 1-year rainfall event) for new development and redevelopment based upon future climate projections.
Philadelphia Climate Action Playbook	2021	The City of Philadelphia Office of Sustainability	Report	4,5	X		X	X		X		X	X	X	X	https://www.phila.gov/documents/philadelphia-climate-action-playbook-resources/	The Philadelphia Climate Action Playbook outlines the actions Philadelphia is taking to respond to climate change through 2050. The Playbook also outlines how climate change will impact Philadelphia and where we need to go further to achieve our goals
Managing Heavy Rainfall with Green Infrastructure: An Evaluation in Pittsburgh's Negley Run Watershed	2020	Fischbach et al	Journal Article	1,2,3,4	X	X		X								https://www.rand.org/pubs/research_reports/RRA564-1.html	The researchers identified potential climate change impacts for the Negley Run watershed, where urgant flood-risk challenges are presented in the city. In the project, the researchers use simulation modeling (SWMM) to evaluate present and future risks in Negley Run from sewer overflows and flooding given future rainfall uncertainty. Then, the authors evaluate proposals for a phsed series of GSI investment. The study also showcases the recreational and other cobenefits of the GSI in addition to the stormwater benefits.
Quantifying the Uncertainty Created by Non-Transferable Model Calibrations Across Climate and Land Cover Scenarios: A Case Study With SWMM	2022	Sytsma et al	Journal Article	4												https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1029/2021WR031603	The paper attempts to quantify the error in model prediction that arises when the optimal calibrated value of effective parameters changes with model forcing. A case study with SWMM was conducted with the specific parameters of subcatchment 'width' and 'connected impervious area'. The authors concluded that variation across forcing parameters can result in significant prediction errors. These results point to a need for additional research to determine how to use urban hydrologic models to make robust predictions across future conditions.
Trees and Hydrology in Urban Landscapes	2021	Whipple et al; San Francisco Estuary Institute & The Aquatic Science Center	Report	1, 2	X	X										https://www.sfei.org/documents/trees-and-hydrology-urban-landscapes	This effort seeks to build links between stormwater management and urban ecological improvements by evaluating how complementary urban greening activities, including green stormwater infrastructure (GSI) and urban tree canopy, can be integrated and improved to reduce runoff and contaminant loads in stormwater systems. This work expands the capacity for evaluating engineered GSI and non-engineered urban greening within a modeling and analysis framework, with a primary focus on evaluating the hydrologic benefit of urban trees. Insights can inform stormwater management policy and planning.
Green Stormwater Infrastructure Maintenance Manual	2016	Philadelphia Water Department	Manual	1, 3	X	X										https://water.phila.gov/pool/files/gsi-maintenance-manual.pdf	Philadelphia's GSI maintanence manual for various stormwater management practices.
Green Stormwater Infrastructure Landscape Design Guidebook	2020	Philadelphia Water Department	Guide	1, 3	X	X										https://water.phila.gov/pool/files/gsi-landscape-design-guidebook.pdf	Philadelphia's GSI landscape design guidebook.
Green Stormwater Infrastructure Planning & Design Manual	2021	Philadelphia Water Department	Manual	1, 3	X	X										https://water.phila.gov/gsi/planning-design/manual/	Philadelphia's GSI planning and design manual.
Examples of Green Infrastructure Projects in San Francisco	2022	San Francisco Public Utilities Commission	Website	1	X	X										https://sfpuc.org/programs/san-franciscos-urban-watersheds/what-green-infrastructure	SFPUC's webpage explaining what is green infrastructre and showing examples of GI. The webpage also include monitoring reports for various existing GI in San Francisco.
FEMA: Nature-Based Solutions	2022	FEMA	Website	1	X											https://www.fema.gov/emergency-managers/risk-management/nature-based-solutions	FEMA's risk management guide focusing on nature-based solutions.

Matrix 1. State of the Science: Resources Exploring the Intersection of Green Stormwater Infrastructure and Climate Change

Title	Year	Author(s)	Resource Type	Priority Item (1 to 5)	Green Stormwater Infrastructure		Climate Change Impact								Focus on Equity	Web Link	Brief Summary
					Mention of GSI	Focus on GSI	Urban Heat	Precip	Snow-fall	Sea Level/ Lake/ Riverine Rise	Water Stress	Bio-diversity	Tree/ Green Equity	Air Quality			
Nature-based solutions for climate change mitigation	2021	United Nation Encironment Programme (UNEP) & Internationl Union for Conservation of Nature (IUCN)	Report	1	X		X	X	X	X	X	X	X	X		https://www.iucn.org/theme/nature-based-solutions	The report shows the benefits and challenges of using nature-based solutions to combat climate changes.
San Francisco Public Utilities Commission Green Stormwater Infrastructure Maintenance Cost Model	2018	San Francisco Public Utilities Commission	Model	1, 3	X	X										https://sfpuc.sharefile.com/d-sd59402b587f4fe59	SFPUC developed this GSI maintenance cost model and have been sharing it with other municipalities. This would serve as a starting point of developing future maintenance cost model with climate resilience in mind.
Reimagining parks as stormwater infrastructure—stormwater parks of all sizes, designs, and funding sources	2019	Bryant et al	Article	1,3, 4, 5	X	X		X								http://www.newea.org/wp-content/uploads/2019/03/NEWEA-Journal_Spr19.pdf#page=19	This paper provides an overview of funding sources, design strategies, water quality improvements, and additional co-benefits provided by multi-objective green stormwater infrastructure in parks and public spaces. Example projects of all sizes from New York City, Atlanta, and Calgary are described, and an example of a successful Institute for Sustainable Infrastructure Envision verification and award process for a stormwater park is also be shared.
Cloudburst Resiliency Planning Study	2017	New York City Department of Environmental Protection & Ramboll	Report	1, 2, 4, 5	X	X		X								https://www1.nyc.gov/assets/dep/downloads/pdf/climate-resiliency/nyc-cloudburst-study.pdf	This executive summary describes the process and fi ndings from the Cloudburst Resiliency Planning Study carried out by Ramboll in 2016. The methodology builds upon Ramboll's experience and city-to-city collaboration regarding cloudburst solutions development for the City of Copenhagen. The purpose of the project is to provide insight on ways to advance climate resiliency projects and traditional stormwater solutions to mitigate inland flooding and accommodate future increase in rainfall intensity through integration with ongoing urban planning and development.
New York City Stormwater Resiliency Plan	2021	NYC Mayor's Office of Resiliency	Plan	1, 2, 5	X	X		X								https://www1.nyc.gov/assets/orr/pdf/publications/stormwater-resiliency-plan.pdf	The Stormwater Resiliency Plan (the "Plan") outlines the City's approach to managing the risk of extreme rain events. Truly holistic planning for rain-driven flooding involves consideration of both large storm events and the chronic worsening of average conditions. For this reason, the Plan addresses emergency response procedures as well as accounting for increasing rainfall in standard design and long term planning of stormwater infrastructure.
An unexpected item is blocking cities' climate change prep: obsolete rainfall records	2022	National Public Radio (NPR)	Article	4				X								https://www.npr.org/2022/02/09/1078261183/an-unexpected-item-is-blocking-cities-	The article points out that the lack of rainfall data is a crital challenge for future planning of storm water infrastructure.
U.S. Climate Resilience Toolkit	2016	NOAA	Website		X		X	X	X	X	X	X	X	X	X	ttps://toolkit.climate.gov	
New Solutions for Sustainable Stormwater Management in Canada	2016	Sustainable Prosperity	Report		X												
Governor Newsom Signs Climate Action Bills	2021	Office of Governor Gavin Newsom	Press Release													https://www.gov.ca.gov/2021/09/23/governor-newsom-signs-climate-action-bills-outlines-historic-15-billion-package-to-tackle-the-climate-crisis-and-protect-vulnerable-communities/	

Matrix 2. Original Studies that Established the Conceptual Model for GSI Design

Title	Year	Author(s)	Resource Type	Priority Item (1 to 5)	Green Stormwater Infrastructure		Climate Change Impact								Focus on Equity	Web Link	Brief Summary
					Mention of GSI	Focus on GSI	Urban Heat	Precip	Snow-fall	Sea Level/ Lake/ Riverine Rise	Water Stress	Bio-diversity	Tree/ Green Equity	Air Quality			
Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs	1987	Thomas R. Schueler for Washington Metropolitan Water Resources Planning Board	Manual	3	X	X										Controlling Urban Runoff | Metropolitan Washington Council of Governments (mwcog.org)	Manual provides detailed guidance on how to plan and design urban best management practices to remove pollutants and protect stream habitats
Design and Construction of Urban Stormwater Management Systems	1992	Water Environment Research Federation and American Society of Civil Engineers	Manual	3	X	X										https://ascelibrary.org/doi/book/10.1061/9780872628557	
Stormwater: Best Management Practices and Detention for Water Quality, Drainage and CSO Management, 2nd Edition	1992	Urbonas and Stahre	Textbook	3	X	X										https://www.amazon.com/Stormwater-Management-Practices-Detention-1992-10-01/dp/B01A65DCAS	
Surface Water Design Manual	1998	King County Stormwater Services	Manual	3	X	X										https://your.kingcounty.gov/dnrp/library/water-and-land/stormwater/surface-water-design-manual/1998-swdm.zip	
Stormwater Collection Systems Design Handbook	2001	Mays	Textbook	3	X	X										https://www.zuj.edu.jo/download/stormwater-collection-systems-design-handbook-pdf/	
Stormwater Treatment: Biological , Chemical, and Engineering Principles	2002	Minton	Textbook	3	X	X										https://books.google.com/books/about/Stormwater_Treatment.html?id=T5rRAAAACAAJ	
CASQA Stormwater BMP Handbook - New Development and Redevelopment	2003	CASQA	Manual	3	X	X											BMP manual from CASQA
Municipal Stormwater Management, 2nd Edition	2003	Debo and Reese	Textbook	3	X	X										https://www.routledge.com/Municipal-Stormwater-Management/Debo-Reese/p/book/9781566705844	
Stormwater Best Management Practices Design Guide (Volume 1, 2, and 3)	2004	U.S. Environmental Protection Agency	Manual	3	X	X										https://cfpub.epa.gov/si/si_public_record_Report.cfm?Lab=NRMRL&dirEntryId=99739	

Matrix 3. Regional-Focused Impacts and Global Hydrologic Impacts of Climate Change

Title	Year	Author(s)	Resource Type	Priority Item (1 to 5)	Green Stormwater Infrastructure		Climate Change Impact								Focus on Equity	Web Link	Brief Summary
					Mention of GSI	Focus on GSI	Urban Heat	Precip	Snow-fall	Sea Level/ Lake/ Riverine Rise	Water Stress	Bio-diversity	Tree/ Green Equity	Air Quality			
Effects of climate change on hydrology and water resources in the Columbia River Basin	1999	Hamlet & Lettenmaier	Journal Article						X								General climate impacts in the Columbia River Basin.
Effects of simulated climate change on the hydrology of major river basins	2001	Arora & Boer	Journal Article					X									The paper explore the potential effects of global warming on the hydrology of 23 major rivers. It focuses on runoff and discharges.
Hydrologic sensitivity of global rivers to climate change	2001	Nijssen et al.	Journal Article						X								Used GCMs to predict future climate impact on hydrology.
The effects of climate change on water resources in the west: Introduction and overview	2004	Barnett et al.	Journal Article														Accessment of the effects of climage change on water resources in the western United States. The assessment focues on the potential chances over the first half of the 21st centry on the Columbia, Sacramento/San Joaquin, and Colorado river basins.
Potential impacts of a warming climate on water availability in snow-dominated regions	2005	Barnett, Adam, & Lettenmaier	Journal Article						X		X						With a modest increase in near-surface air temperature, the alterations of the hydrological cycle are expected to take place via seasonal shifts in stream-flow in snowmelt-dominated regions. This change can lead to regional water shortages in areas without adequate water storage capacity.
Changes toward earlier streamflow timing across Western North America	2005	Stewart, Cayan, & Dettinger	Journal Article						X								Changes in timing of snowmelt-derived streamflow from 1948 to 2002 were investigated through trend and principal component analyses.
Human-induced changes in the hydrology of the Western United States	2008	Barnett et al.	Journal Article														Used hydrological models together with global climate models to show that up to 60% of the climate-related trends of river flow, winter air temperature, and snowpack between 1950 to 1999 are human-induced.
Implications of 21st century climate change for the hydrology of Washington State	2010	Elsner et al.	Journal Article						X								Impacts of climate changes on the hydrological cycle in Pacific northwest; focus on the greater Columbia River watershed and Yakima River watershed; main parameters looked at are snow water equivalent, soil moisture, runoff, and streamflow under different emissions scenarios
Adapting to the impacts of climate change	2010	National Research Council	Report	5													General climate changes in the US and adaptation options and strategies.
Climate change effects on stream and river temperatures across the northwest U.S. from 1980-2009 and implications for salmonid fishes	2012	Isaak et al.	Journal Article									X					The team assembled 18 temperature time-series from sites on regulated and unregulated streams in the NW US to describe historical trends from 1980 to 2009 and assess thermal consistency between these stream categories.
Geomorphological records of extreme floods and their relationship to decadal-scale climate change	2014	Foulds et al.	Journal Article														Study of the geomorphological traces of extreme rainfall and floods occurrence between 1900 to 1960 in the Cambrian Mountains of Wales, UK.
Estimates of Twenty-First-Century Flood Risk in the Pacific Northwest Based on Regional Climate Model Simulations	2014	Salathe et al.	Journal Article					X									The paper shows substantial increases in future flood risk (2040-69) in many Pacific Northwest river basins in the early fall using a regional climate model simulation. Two primary causes: more extreme and earlier storms and warming temperatures that shift precipitation from snow to rain domincance over regional terrain
Local Enhancement of Extreme Precipitation during Atmospheric Rivers as Simulated in a Regional Climate Model	2018	Lorente-Plazas et al.	Journal Article					X									This paper examins the synoptic conditions that yield extreme precipitation in two regions with different orographic features, the Olympic Mountains and Puget Sound.
Integrated Vulnerability Assessment of Climate Change in the Lake Tahoe Basin	2020	CA Tahoe Conservancy & Catalyst Environmental Solutions	Report					X	X		X	X				tahoe.ca.gov/vulnerability-assessment	This report aims to provide residents, visitors, businesses, and public agencies with state-of-art information on how patterns of temperature and precipitation will change, and how these patterns will affect the things people care about.

Our Water Our World

Annual Summary Report

California Stormwater Quality Association

September 2022

CALIFORNIA STORMWATER QUALITY ASSOCIATION

Preface

The California Stormwater Quality Association (CASQA) is a nonprofit corporation that advances sustainable stormwater management protective of California water resources. With approximately 2,000 members, CASQA's membership is comprised of a diverse range of stormwater quality management organizations and individuals, including over 180 cities, 23 counties, special districts, federal agencies, state agencies, ports, universities and school districts, wastewater agencies, water suppliers, industries, and consulting firms throughout the state. Collectively, CASQA represents over 26 million people in California.

This report provides CASQA's members with focused information on its efforts to raise awareness about the connection between pesticide use and water quality through the Our Water, Our World program (OWOW). The goal of Our Water, Our World is to support a statewide integrated pest management IPM outreach program that provides direct to consumer information on less-toxic IPM practices.

By focusing on true source control and public outreach, OWOW advances two core components of *CASQA's Vision for Sustainable Stormwater Management*[1] (Principles 1 and 3).

Acknowledgements

Our Water, Our World is funded by CASQA, the organizations implementing the OWOW program (see Table 1 in Section 2 of this report) and is sponsored by the Bay Area Clean Water Association (BACWA). This report was prepared by Suzanne Bontempo, with support from Roshan Christoph (CASQA).

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[1] https://www.casqa.org/sites/default/files/downloads/final_-_vision_for_sustainable_stormwater_management_-_10-07-2020.pdf

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Section 1. Introduction

Our Water Our World (OWOW) Our Water, Our World (OWOW) is an award-winning partnership between city- and county-based water pollution prevention agencies and garden centers and hardware stores that sell pest control products. Initiated in 1998, the program focuses on less-toxic, eco-friendly products and techniques as many common pesticides are harmful to sensitive species and ecosystems when they reach local creeks, bays, and the ocean.

OWOW started as a pilot project in 1998, in just a handful of stores, initiated by the Contra Costa County Sanitation District, the City of Palo Alto Regional Water Quality Control Plant, and the Marin Countywide Stormwater Pollution Prevention Program. The program quickly grew and was administered by the former Bay Area Stormwater Management Agencies Association from 1999 – 2021. During that time, over 130 agencies in 16 counties implemented the program, working in approximately 239 stores. Starting in January 2022, the program was transferred to CASQA, with the goal of providing statewide access to this important and successful outreach program.

From a stormwater management perspective, OWOW is an excellent opportunity and cost-efficient way to educate the public and reduce toxicity in waterways from current use pesticides. Several municipalities utilize OWOW to meet permit requirements, including the San Francisco Bay Area Municipal Regional Permit[2], the Central Valley Region-wide MS4[3], and the Phase II – Small MS4 General Permit[4].

This report provides a summary of the OWOW program activities implemented between July 2021 and June 2022.

Section 2. OWOW Program Elements

The OWOW program consists of several elements, which are integral to its effectiveness.

2.1 INTEGRATED PEST MANAGEMENT (IPM) ADVOCATES

A critical component of the program, IPM Advocates are individuals who have been specifically trained on how to engage with retailers and the public. IPM Advocates provide in-store presentations and advice to customers about pest management methods that are healthier for people and the environment. IPM Advocates also provide training for store employees and on an annual basis, receive continuing education and training.

2.2 EDUCATIONAL MATERIALS

In the store, consumers are directed to less-toxic products and techniques through a variety of ways:

- Fact sheets are provided to educate the public on a wide range of pest management topics
- Shelf tags and display materials guide customers to less-toxic products
- Additional educational resources are provided, such as product lists and information about active ingredients in pest management products
- Many of the educational outreach materials provided in-store are being updated to include QR codes, linking directly to the OWOW website.

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[2] Municipal Regional NPDES Permit and Waste Discharge Requirements General Permit for Discharges from Municipal Separate Storm Sewer Systems (MS4), California Regional Water Quality Control Board – San Francisco Bay Region, 2009. Water Quality (WQ) Order R2-2009-0074-DWQ, NPDES NO. CAS612008, CA.

[3] Municipal Regional NPDES Permit and Waste Discharge Requirements General Permit for Discharges from Municipal Separate Storm Sewer Systems (MS4), California Regional Water Quality Control Board – Central Valley, 2016. Water Quality (WQ) Order R5-2016-0040-DWQ, NPDES NO. CAS0085324, CA.

[4] NPDES Permit for Waste Discharge Requirements for Discharges from Small MS4, California State Resources Control Board, 2013. WQ Order 2013-0001-DWQ, NPDES No. CAS000004, CA.

Online, via the OWOW website, consumers can view the following:

- All 18 fact sheets
- A list of stores participating in OWOW in their local communities
- A current list of eco-friendly and less-toxic products available in stores

2.3 TRADE SHOWS

OWOW representatives provide exhibits annually at trade shows to educate buyers on less-toxic products. Participation in these events in a critical step to ensure stores carry less-toxic products.

Section 3: OWOW Partnerships

The program is currently administered by CASQA, implemented by local cities and counties, with IPM Advocates and University of California Statewide IPM Program (UC IPM) serving as collaborative partners as shown in Figure 1.

CASQA manages and provides the central services necessary to operate and maintain Our Water, Our World, including the development of the in-store education materials (e.g., less-toxic product lists, label files, and active ingredient lists), creation and updates of outreach materials, operation and updates to the OWOW website, vendor (i.e., retail partners and pesticide distributors) outreach, preparation of an annual report, fulfillment of outreach materials orders, and program management and development.

IPM Advocates are highly trained individuals that support local implementation of the OWOW program in retail stores and are a crucial component of the OWOW program. They provide retail nurseries, hardware stores, and garden centers direct to consumer information on integrated pest management tools, products, and practices. They are the link between the municipalities and the retailers where they reach consumers. the IPM Advocates provide IPM trainings for store staff, and host webinars and events for customers via separate contracts with local agencies. Suzanne Bontempo was contracted by CASQA to coordinate the IPM Advocates to keep continuity within the program, hold regular meetings to communicate updates on new pests and new pest management techniques, and maintain the outreach material. The active IPM Advocates include: Suzanne Bontempo, Debi Tidd, Julie Barbour, Lorenzo Levinger, Charlotte Canner, Maris Sidenstacker, and Lisa Ratusz.

The UC IPM Program provides research and expertise on IPM practices promoted throughout the state and maintains a website of less-toxic integrated pest management practices for nearly 1000 home, garden, landscape, and turf pests. Karey Windbiel-Rojas, Staff Director for Urban and Community IPM, UC IPM Program has been involved with the IPM Advocate program since its inception and continues to assist with advocate training, technical resources on pest management practices, and as a liaison with UC resources.

Municipal agencies subscribe to OWOW through CASQA and implement the OWOW program in their local retail stores by contracting with IPM Advocates or using municipal staff or other contractors. Implementation may be implemented by a single agency at stores within their jurisdiction or organized at a regional scale, where Agencies combine resources to implement the OWOW program at select stores used by multiple jurisdictions. In addition, municipal agencies conduct outreach to educate residents about the OWOW program.

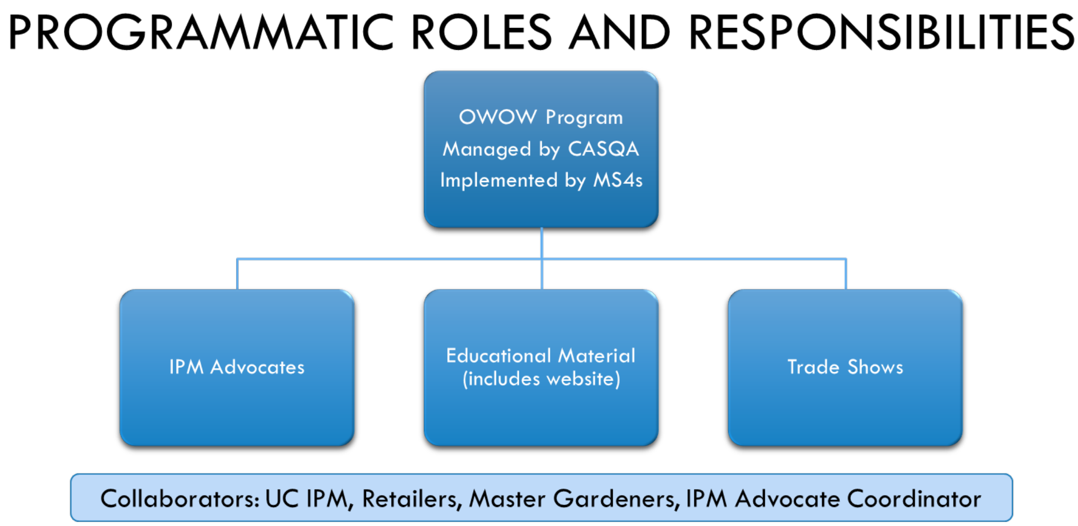

Figure 1. OWOW Program Roles and Responsibilities

Table 1 provides the list of agencies implementing OWOW as of June 30, 2022. Bay Area Clean Water Agencies (BACWA) continue to support the OWOW program as a sponsor.

Table 1 List of Agencies Implementing OWOW

Bay Area

Alameda County

Alameda County Flood Control & Water Conservation District

Alameda County Public Works Agency

City of Alameda

City of Albany

City of American Canyon

City of Antioch

City of Belmont

City of Belvedere

City of Berkeley

City of Brentwood

City of Brisbane

City of Burlingame

City of Calistoga

City of Campbell

City of Clayton

City of Cloverdale

City of Concord

City of Cotati

City of Cupertino

City of Daly City

City of Dublin

City of East Palo Alto

City of El Cerrito

City of Emeryville

City of Foster City

City of Fremont

City of Half Moon Bay

City of Hayward

City of Healdsburg

City of Hercules

City of Lafayette

City of Larkspur

City of Livermore

City of Los Altos

City of Martinez

City of Menlo Park

City of Mill Valley

City of Millbrae

City of Milpitas

City of Monte Sereno

City of Mountain View

City of Napa

City of Newark

City of Novato

City of Oakland

City of Oakley

City of Orinda

City of Pacifica

City of Palo Alto

City of Piedmont

City of Pinole

City of Pittsburg

Bay Area (Con't)

City of Pleasant Hill

City of Pleasanton

City of Redwood City

City of Richmond

City of Rohnert Park

City of San Bruno

City of San Carlos

City of San Jose

City of San Leandro

City of San Mateo

City of San Pablo

City of San Rafael

City of San Ramon

City of Santa Clara

City of Santa Rosa

City of Saratoga

City of Sausalito

City of Sebastopol

City of South San Francisco

City of St. Helena

City of Sunnyvale

City of Ukiah

City of Walnut Creek

Contra Costa Clean Water Program

Contra Costa County

County of Alameda

County of Marin

County of Napa

County of San Mateo

County of Santa Clara

Marin Countywide Stormwater Pollution Prevention Program

Mendocino County

Napa Countywide Stormwater Pollution Prevention Program

San Mateo Countywide Water Pollution Prevention Program

Santa Clara Valley Water District

Sonoma County

Sonoma County Water Agency

Town of Atherton

Town of Colma

Town of Corte Madera

Town of Danville

Town of Fairfax

Town of Hillsborough

Town of Los Altos Hills

Town of Portola Valley

Town of Ross

Town of San Anselmo

Town of Tiburon

Town of Windsor

Town of Woodside

Town of Yountville

Union City

Vallejo Flood and Wastewater District

Zone 7 Water Agency

Central Valley

Butte County

City of Ceres

City of Davis

City of Escalon

City of Lathrop

City of Lincoln

City of Lodi

City of Manteca

City of Newman

City of Patterson

City of Ripon

City of Riverbank

City of Roseville

City of Sacramento

City of Stockton

City of Tracy

City of Turlock

City of West Sacramento

City of Woodland

City of Yuba City

County of Sacramento

County of San Joaquin

El Dorado County

Fresno Metropolitan Flood Control District

Sacramento Stormwater Quality Partnership

Mountain House Community Service District

San Joaquin County

Stanislaus County

Yuba City

Central Coast

City Buellton

City of Carmel-by-the Sea

City of Carpinteria

City of Del Rey Oaks

City of Goleta

City of Monterey

City of Pacific Grove

City of Sand City

City of Santa Maria

City of Seaside

City of Solvang

County of Monterey

Santa Barbara County

Southern California

City of Santa Clarita

Sponsor

Bay Area Clean Water Agencies (BACWA)

Section 4. Annual Program Implementation (2021-2022)

The following OWOW outreach services were conducted between July 2021 and June 2022.

4.1 IPM ADVOCATES

After training by the University of California IPM Program, Advocates are contracted by local municipalities and then assigned to stores, where they pass on their knowledge to staff and hold educational events for customers Excellent relationships between the Advocates and store management and staff are key to the successful promotion of less-toxic, eco-friendly projects. Current IPM Advocates were trained prior to COVID-19 pandemic. Between July 2021 and June 2022, no training for new or existing IPM advocates was conducted.

IPM Coordination

Ms. Bontempo held regular meetings to communicate updates on new pests and new pest management techniques with current IPM Advocates.

DPR Grant Application

In the spring of 2022, CASQA and collaborating partners initiated worked on a draft DPR grant application to fund the development of a IPM Advocate Training Program. The application was held hold until the program needs are further refined, and the best funding approach is identified. The future activities to develop a IPM Advocate Training Program are described in Section 5.

4.2 EDUCATIONAL OUTREACH MATERIAL

Educational material includes fact sheets for specific pests, gardening and pesticide applications, shelf labels to identify eco-friendly products in stores, and OWOW website that makes the material accessible to the public. Some examples of OWOW outreach materials are provided in Appendix A. New OWOW outreach materials were not printed in this reporting year as the local jurisdictions and IPM Advocates had sufficient materials in stock.

Fact Sheets

There are 18 OWOW fact sheets available, including four (4) available in both English and Spanish. During the COVID-19 pandemic, the need to transition from paper fact sheets to a digital option was identified. Trackable QR codes were created to digitally access the OWOW fact sheets in the pesticide aisle at each retailer. The trackable QR codes record which fact sheets are viewed by consumers in retail stores. The trackable QR code posters were developed in 2021 and made available in select stores starting January 2022. According to the data from the QR code posters, the top three fact sheets viewed between January and June 2022, were ants, rats and mice, and moles, voles, and gophers. Table 2 presents a summary of QR code scans per month for each fact sheet.

Website

The [OWOW website] provides public access to OWOW outreach material, IPM resources, and the Store Locator, an interactive map to search for participating stores. Updates to the [Store Locator] are made on a quarterly basis. The Store Locator was revised in June 2022 to add 11 new participating stores and remove 6 stores that are closed or no longer supporting the OWOW program.

Store-based Product Lists

The store-based product lists provide the current lists of the eco-friendly products that the Home Depot stores and Ace Hardware stores sell each year. IPM Advocates use the store-based product lists to identify the eco-friendly products on store shelves using labels or “shelf talkers/tags”. Each year, the lists are reviewed, and updates are made as needed in consultation with subject-matter-experts. This year, the new products had the same active ingredients as others and therefore, no revisions were necessary. Each year, more pesticide companies label eco-friendly products responding to purchasing habits by the consumer. Appendix B provides the products lists from 2022.

Table 2. Summary of QR Code Scans by OWOW Product: January to July 2022

OWOW Product	Total	Jan 2022	Feb 2022	March 2022	April 2022	May 2022	June 2022
OWOW Website	45	1	5	16	8	8	7
Ants	83	1	6	25	22	11	18
Aphids	62	0	3	19	16	11	13
Bed Bugs	29	0	3	4	9	5	8
Cockroaches	65	0	5	10	19	14	17
Fleas	40	0	3	4	14	10	9
Healthy Gardens	25	0	2	7	9	5	2
Hiring a Pest Co	15	0	2	4	5	3	1
Lawns	17	0	3	1	1	4	8
Moles Voles Gophers	92	0	6	25	25	14	22
Mosquitoes	51	0	9	8	13	11	10
Pesticide U&D	16	0	2	2	4	6	2
Pesticides & Water Quality	9	0	1	2	1	3	2
Rats & Mice	68	1	3	15	18	15	16
Roses	38	1	7	9	8	7	6
Snails & Slugs	36	0	2	9	15	4	6
Spiders	30	1	2	3	6	11	7
Weeds	21	1	2	6	6	3	3
Yellowjackets	30	1	2	8	9	7	3
Spanish Fact Sheets	23	1	2	9	2	5	4
Total	795	8	70	186	210	157	164

4.3 VENDOR OUTREACH

Education of vendors and retailers on less-toxic products is a critical step to ensure stores carry less-toxic products.

Retail Partners

Ms. Bontempo as the IPM Advocate Coordinator leads collaboration with key retail partners. During the past year, she maintained a relationship with the Home Depot Corporate Sustainability Officer. She communicates quarterly to keep goals aligned and to provide Home Depot with updates on OWOW activities in the stores. Each year, OWOW receives a letter of support from the Home Depot Corporate Sustainability Officer that facilitates collaboration with local retailers. Home Depot Corporate is a model retailer partner and OWOW strives to replicate this partnership with other retailers and vendors. Ms. Bontempo plans to initiate communications with new contacts at Lowe's. She has also met with the CNRG Ace Hardware group with the goal of expanding the OWOW program into more of their stores. hardware group in hopes to expand the OWOW program throughout their stores.

Vendor Communication

OWOW has established relationships with national pesticide manufacturers. Annual communication with vendors is essential to learn about new pesticide active ingredients, products, and market trends. Key vendors have reported many obstacles in 2022 as follows:

- Supply chains are still straining product supply
- In-store sales have returned from the pandemic
- During a drought, consumers tend to purchase less live plant material.
- Consumer expendable cash flow is less available due to inflation and fuel cost

Trade Show Booths

Attending trade shows provides an opportunity to meet the vendors, learn about the new products coming onto the marketplace in California, answer questions, and provide mentorship to the retail buyers. In 2022, OWOW representatives planned to attend trade shows, however, the in-person events were suspended due to COVID-19. Below is the list of trade shows that OWOW representatives typically attend each year.

- Central Lawn & Garden Distributor Trade Show, Las Vegas NV
- L&L Nursery Distributor Trade Show, Reno, NV: OWOW representatives joining the L&L Distributors virtual trade show.
- NorCal Landscape Trade Show, San Mateo, CA

4.4 TRAINING AND OUTREACH FOR RETAILERS AND CONSUMERS

IPM Advocates and other OWOW service providers conduct OWOW outreach activities to educate retailers and consumers at the local level. Local OWOW Implementation activities vary between agencies. Agencies receive tailored OWOW reports from their contracted IPM Advocate with a summary of their local OWOW data (for example, the number of trainings, the number of staff trained, and/or the number of fact sheet distributed).

IPM Advocates provided OWOW services to approximately 243 participating retailers throughout California. This reporting year, 9 retailers were added in the Sacramento area, Marin County, Alameda County, Sonoma County, and Contra Costa County. Table 3 provides a summary of outreach activities between July 2021 and June 2022. These activities were funded by local municipalities and stormwater programs.

Table 3 Summary of Outreach Activities

Audience	OWOW Outreach Activity
Retailers	243 retailers participating in the OWOW program
	115 trainings were conducted
	768 retail staff were trained
Direct to Consumer	99 OWOW public outreach events
	8781 people attended OWOW public outreach events (In person and virtually)
	795 scans of QR Codes for OWOW fact sheets

Note: QR Code tracking began January 1, 2022

IPM Advocates conducted 115 trainings and trained 768 retail store staff. Main topics include IPM, managing pest problems with a less-toxic approach. In addition, IPM Advocates provided tips for new gardeners and how to protect gardens in the time of drought. Education has expanded to include protecting gardens during times of drought since plants are more prone to pest problems when they are (drought) stressed. IPM Advocates provided more digital support including a monthly retailer e-newsletter, online webinars and social media posts to the public. These activities are described in more detail below.

Impacts due to COVID-19 Pandemic:

- Retailers were still impacted by the supply chain challenges and inventory shortages.
- Retailers were also challenged by labor shortages, frequent new hires, and key staff out due to coronavirus related exposure or illness.
- Scheduling staff trainings for the retailer partners was challenging due to labor shortages and staff calling out due to coronavirus exposure. This caused IPM Advocates to reschedule several trainings, and/or work with the few staff present on the day.
- When in-person, IPM Advocates worked with store staff in smaller groups of multiple training sessions back-to-back.

OWOW Retailer e-Newsletter:

- Currently, of the total 243 retailers, there are 161 retailers receiving the e-newsletters.
- A monthly newsletter is emailed to participating retailers at the beginning of each month. This newsletter contains information on seasonal pest problems and eco-management solutions and assists with ensuring that all key store staff, including managers, are receiving the information. Many of the managers print the OWOW newsletter and post it for all staff to review. The newsletter lists the upcoming events that IPM Advocates are participating in, such as in-person tabling events or on-line webinars. Retailers have then posted the relevant events into their newsletters that are sent out to their customers. The newsletter also includes information on upcoming professional trainings, such as the Qualified Water Efficient Landscape (QWEL) trainings.

OWOW IPM Educational Webinars:

- Webinars were developed in lieu of in-person outreach events during the first year of the COVID-19 pandemic. These webinars have grown in popularity and now are a regular service provided by IPM Advocates to agencies that contract with them at the local scale. Each registrant received a program outline and a 'Helpful Gardening Resource' page.

OWOW IPM Social Media Posts/Tips:

- OWOW IPM tips were created for social media content as an additional way to expand the OWOW message to the public. IPM Advocates create seasonal content as a guide to prevent and manage each pest. This public outreach option is available at the local scale to those agencies contracted with an IPM Advocate. Agencies retain data of views and responses to each post.

Twelve bilingual IPM tips were provided throughout the contract year:

- Rodent exclusion
- Fall for planting
- Hiring a Pest Control Company
- Organic Fertilizers
- Rose Care
- Composting
- Yellow jacket prevention
- Installing a rain garden
- Dormant sprays
- Weed management
- Mosquitos
- Powdery mildew

Section 5: OWOW Program Development

To support a growing demand for OWOW outreach material and IPM Advocates, there are efforts currently underway, as well as future considerations, that are necessary to advance the OWOW program and its services.

5.1 UPDATES IN PROGRESS

Review of OWOW Outreach Materials

CASQA is establishing a review process for OWOW materials. In 2023, it is anticipated that OWOW outreach materials will be reviewed for technical accuracy and updated by subject matter experts. Retailer e-newsletters will be reviewed by subject matter experts prior to release starting July 2022. OWOW will also be coordinated with CASQA's larger pesticide regulatory work (CASQA, 2022) [5].

New Order Process for OWOW Outreach Materials

The process for ordering OWOW outreach material was modified to conduct bulk ordering twice per year (starting August 2022). Ordering in bulk provides the best price for all materials. CASQA developed a new online order form to compile the bulk order.

5.2 FUTURE CONSIDERATIONS

Annual Reporting

In 2023, CASQA will develop a new process, schedule and supporting templates and tools, as needed, for OWOW Subscribers to report on OWOW implementation activities. This information can then be integrated into the Annual Report to provide a more robust perspective of local implementation activities throughout the state.

IPM Advocate Training Program

To operate at a statewide scale, and in a sustainable manner, certain aspects of the existing OWOW program must be formalized and expanded. In 2022, CASQA began developing an outline for a potential Qualified IPM Advocate Training Program. CASQA will coordinate workgroups comprised of OWOW Subscribers, current IPM Advocates, and training experts to develop a framework for the Qualified IPM Advocate Training Program. This framework will be utilized to seek outside funding (e.g., a future grant application or partnership with another organization).

IPM Advocate “In-Training”

While IPM Advocate training opportunities are not available, Suzanne Bontempo, as the IPM Advocate Coordinator will provide support for individuals interested in becoming IPM Advocates. The IPM Advocate “In-training” program will ensure that individuals providing OWOW outreach services in stores are providing the latest information and are consistent with the program. The IPM Advocate “In-training” program will be initiated in Fall of 2022 and provide a bridge for additional IPM Advocate services until the Qualified IPM Advocate program can be developed and implemented.

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[5] See report from 2022. the Pesticide Annual Report and Effectiveness Assessment. California Stormwater Quality Association. Sacramento, CA. This document is available in the CASQA Member Library.

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Appendix A – Images of OWOW Outreach Materials

Figure A.1 Trackable QR Code Poster in Store Aisle

EFFECTIVE ECO-FRIENDLY PEST CONTROL • LESS-TOXIC PRODUCTS

CONTROLLING ANTS IN YOUR HOME

CONTROL ANTS IN YOUR HOME WITH THESE ECO-FRIENDLY PRODUCTS

Bait stations containing borates or hydramethylnon	Amdro Kills Ants Ant Killer, Amdro Kills Ants Ant Killing Bait, Combat Source Kill 4 products, KM Ant Pro products, Maggie's Farm Simply Effective No Spill Ant Kill, Terro Ant Killer II Liquid Ant Baits
Diatomaceous earth (DE) products	Concern Diatomaceous Earth Crawling Insect Killer, Safer Brand Diatomaceous Earth Ant and Crawling Insect Killer, St. Gabriel Organics Insect Dust—Diatomaceous Earth
Applicator for diatomaceous earth (DE)	Pest Pistol
Plant-based insecticides	EcoLogic Ant and Roach Killer, Ecosmart Ant and Roach Killer, Orange Guard
Hose attachment	Bug Blaster
Sticky barrier	Stikem Special pest glue, Tree Tanglefoot Insect Barrier

Argentine ants are frequent invaders in California homes. They are tiny (1/8 inch). They come inside a few at a time at first (the scouts), and then in long lines, following scent trails to a food source.

A QUICK FIX FOR AN ANT EMERGENCY

If you deal with ants when they first come inside, a few simple steps can take care of the problem.

1. Find what ants are after (usually leftover food) and where they are entering the room (usually through a crack in the wall). Mark the spot so you can find it again. If you can't find an entry point, see Step 4.
2. Spray lines of ants with soapy water and wipe up with a sponge, and clean up any food or spills.
3. Next, block entry points temporarily with a smear of petroleum jelly or a piece of tape.
4. If you can't find an entry point, clean up the ants (Step 2). Place a bait station in an out-of-the-way spot on the line the ants have been following. Remember to remove the bait station when the line of ants has disappeared so you don't attract more ants into the house. (See *Tips for Using Ant Baits.*)

While they can be pests, ants are helpful creatures, especially outside. Ants kill and eat many pest insects, help to aerate soil, and recycle animal and vegetable material. This is good news, because it's probably not possible to eliminate ants from their outdoor habitat. The best way to manage an ant invasion is to keep them outside.

KEEP ANTS AWAY

- Store food in the refrigerator, or in containers that seal tightly.
- Keep things clean and dry, and fix leaking faucets and pipes (ants come in to find water as well as food).
- Weather-strip doors and windows.

Choose eco-friendly products for your home and garden. Look for this symbol before you buy.

Figure A.2 Ant Fact Sheet

OWOW Retail Newsletter July 2022 edition

July: Powdery Mildew, rodent exclusion, shade cloth and anti-transpirant
June: Mosquitos, Yellow jackets & Flies or Cucumber beetles

Powdery Mildew
As the summer temperatures warm up & dry out, powdery mildew seems to come on strong. This fungus is most noticed it on the leaves of crape myrtles, summer squash, roses, tomatoes and so many more.

Powdery mildew is a common fungal disease found on many different types of plants. It appears as a white or grayish, powdery growth that is most commonly found on leaf surfaces, but may also infect buds, shoots and even flowers and fruits. This 'powder' is actually the mycelium and spores of the fungi. Powdery mildew is rarely fatal, however on some plants, leaves may yellow and fall off, and leaves and shoots may distort.

There are many different types of powdery mildew fungi that can cause the disease, and spores can be spread to new plants by wind. But all of the spores need leaves free of water to germinate, so water on the plant surfaces can actually inhibit germination and kill the spores. Ideal conditions for powdery mildew are temperatures between 60° and 80° F, but it can be active in temperatures from 55° and 90° F. It is most common in shady conditions and dense plantings.

PREVENTION
The best way to manage powdery mildew is to prevent it through cultural practices.

- Place plants in full sun where possible, and provide good air circulation
- Avoid excess fertilizer that stimulates new growth that is more prone to the fungus. Use compost and organic fertilizers to prevent excessive tender, overgrown foliage that shades the leaves and provides the right conditions for the fungus.
- Prune out small infestations, but don't over-prune to avoid rapid growth.
- Irrigate plants by watering leaves mid-morning to kill the spores, and to allow leaves to dry quickly to avoid other fungal infections.
- Clean up dead plant material and fallen leaves so that spores don't spread and won't be able to overwinter in plant tissue.
- Choose plant varieties that are resistant to powdery mildew when possible.

USING FUNGICIDES
In case of severe infections, there are several environmentally friendly products that can help to manage powdery mildew. Most of these products are best used to prevent powdery mildew, so apply them to plants susceptible to the disease before you see the powdery mildew or in the very beginning stages. Thoroughly cover all plant parts, including under the leaves. Additional applications may be needed as the plant grows.

Figure A.3 July e-Newsletter Page 1

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Appendix B – Product Lists January 2022

The Home Depot product list 2022:

Pesticide Bays

Amdro Gopher Traps
BioAdvance House Plant Insect & Mite Control
Bird-B-Gone Stainless Steel Bird Spikes
Black Flag Pantry Pest Trap
Black Flag Roach Motel
Bonid Captain Jack's Lawnweed Brew
Bonide Copper Fungicide
Bonide Cpt Jack's Dead Bug Brew
Bonide Cpt Jack's Dead Weed Brew
Bonide Cpt Jack's Neem Max 70%
Bonide Insecticidal Super Soap
Bonide Mole Max
Bonide Neem Oil
Bonide Orchard Spray
Bonide Repels All
Bonide Rose Rx
Bonide Tomato & Vegetable
Buggy Beds Bed Bug Trap
Critter Ridder
Cutter Essentials Bug Control
Cutter Essentials Outdoor Fogger
Dr. Earth Pest Control Insect Killer
EcoLogic Ant & Roach Killer
EcoLogic Bed Bug Killer
EcoLogic Home Insect Control
Fly Swatter
Garden Safe Fungicide 3
Garden Safe Houseplant & garden
Garden Safe Insecticidal Soap
Garden Safe multi Garden Insect
Garden Safe Neem Oil
Garden Safe Rose & Flower
Garden Safe Slug & Snail
Gopher Traps
Green Gobbler 20% Vinegar Weed Killer
Harris Roach Tablets
Havahart Live Animal Trap
Hot Shot Bed Bug Killer Dust
Hot Shot MaxAttrax Roach Killing Powder
Liquid Fence Deer & Rabbit Repellent
Monterey B.t.
Mosquito Dunks
Mouse Traps
Mouse X
Ortho Bed Bug Trap
Ortho Ground Clear Weed & Grass Killer (green label)
Owl, Garden Defense
Raid Ant Baits III
Raid Fly Ribbon
Raid Fly Stick
Raid Fly Trap
Raid Window Fly Trap
Rat Traps
Rat X
Rescue Fly Trap
Rescue Fly Trap Refill
Rescue Outdoor Fly Trap
Rescue W-H-Y Trap
Rescue W-H-Y Trap Refills
Rescue Wasp Trap Stik
Rescue Yellow Jacket Trap
Rescue Yellow Jacket Trap Cartridge
Rescue Yellow Jacket Trap Refill
Sevin 2-in-1 Sulphur Dust
Safer Brand Ant, Roach & Spider Killer
Safer Brand Diatomaceous Earth Crawling Insect Killer
Safer Brand Home Pest Control
Safer Brand Indoor Fly Trap
Safer Brand Indoor Fly Trap Refills
Safer Brand Snake Shield
Skunk Scram Repellent Granulars
Southern Ag Thuricide Bt
Terro Flea Trap
Terro Fruit Fly Trap

Terro Indoor Fly trap
Terro Liquid Ant Bait
Terro Multi-Surface Liquid Ant Baits
Terro Outdoor Liquid Ant Bait Stakes
Tom Cat Attractant Gel
Tom Cat Mouse Trap
Tom Cat Rat Traps
Tom Cat Rodent Repellent
Treekote Aerosol Tree Wound
Uncle Ian's Dog & Cat Repellent
Uncle Ian's Mole, Gopher, Deer, & Squirrel Repellent
Victor Electric Mouse Trap
Victor Electric Rat Trap

Ferilizer Bays

Alaska Fish Fertilizer
Dr Earth Lawn Food
Dr. Earth Fertilizer
Earthworm Castings
Espoma Fertilizer
Espoma Organic Lime
Espoma Organic Soil Acidifier
First Saturday Lime Insect Repellent
Kellogg Organic Plus Fertilizer
Kellogg Organic Plus Lawn Fertilizer
Kellogg Organic Plus Fish & Kelp Fertilizer
Mater Magic
Miracle-Gro Fertilizer Spikes
Miracle-Gro Fertilizer Spikes Tree & Shrub
Miracle-Gro Performance Organics
Monterey Fish & Guano Fertilizer
Osmocote
Pennington Epson Salts
True Organic Fertilizer
True Organic Blood Meal
True Organic Bone Meal
Vigoro Fertilizer Spikes
Vigoro Tree & Shrub Fertilizer Spikes
Vigoro Fruit, Nut &Citrus Fertilizer Spikes

Victor Gopher Traps
Victor Mouse Traps
Victor Rat Traps
Victor Rat-A-Way Rat & Mouse Repellent
Victor Rodent Repeller Packs
Weed Block Landscaping Fabric
Weed Control Fabric
Zevo Ant, Roach & Spider
Zevo Fly, Gnat & Fruit Fly
Zevo Flying Insect Trap
Zevo Multi Insect
Zevo Wasp, Hornet, & Yellow Jacket

The ACE Hardware product list 2022:

Alaska Fish Fertilizer
Amdro Kills Ants Ant Killer
Answer Kills Roaches Powder
Bed Bug Traps
BioCare Codling Moth Traps
Bird Repellent Gel
Bird Scare Tape
Bird-B-Gone Flash Tape
Bird-B-Gone Steel Bird Spikes
Black Flag Roach Motel
Black Flag Window Fly Traps
Bonide All Seasons Spray Oil
Bonide Burnout
Bonide Captain Jack's Dead Bug Brew
Bonide Chipmunk, Squirrel, & Rodent Repellent
Bonide Copper Fungicide
Bonide Go Away! Rabbit, Dog, & Cat Repellent
Bonide Hot Pepper Wax Animal Repellent
Bonide Insecticidal Soap
Bonide Mole Max
Bonide Mosquito Beater
Bonide Mouse Magic
Bonide Neem Oil
Bonide Rat Magic
Bonide Repels All
Bonide Snake Stopper
Bonide Sulfur Fungicide
Bonide Tomato & Vegetable
Bonide Wilt Stop
Buggy Beds
Cloud Cover
Combat Ant Killing Bait
Combat Roach Killing Bait
Critter Ridder Sprinkler
Good Nature CO2 Rodent Trap
Gopher Baskets
Gopher Hawk
Gopher Scram
Gopher Traps
Harris 20% Vinegar Weed Killer
Harris Bed Bug Killer Diatomaceous Earth
Harris Boric Acid Roach Powder

De-Fence Deer & Rabbit Repellent
Deer Off Deer Repellent
Diatomaceous Earth
Dr. Earth Final Stop Disease Control Fungicide
Dr. Earth Final Stop Fruit Tree Insect Killer
Dr. Earth Final Stop Rose & Flower Insect Killer
Dr. Earth Final Stop Vegetable Insect Killer
Dr. Earth Final Stop Yard & Garden Insect Killer
Dr. Earth Organic Fertilizer
Drop in the Bucket Mouse Trap
E.B. Stone Organic Fertilizer
Earth's Ally Disease Control
Earth's Ally Insect Control
Earth's Ally Weed & Grass Killer
Earth's Ally Weed Killer
EcoSmart 3 in 1 Rose & Flower
EcoSmart Ant & Roach Killer
EcoSmart Flying Insect Killer
EcoSmart Garden Insect Killer
EcoSmart Home Pest Control
EcoSmart Insect Killer
EcoSmart Insect Killing Granules
EcoSmart Mosquito Fogger
EcoSmart Wasp & Hornet Killer
EcoSmart Weed & Grass Killer
Epsom Salts
Espoma Garden Lime
Espoma Organic Fertilizer
Espoma Organic Insect Soap
Espoma Soil Acidifier
Fly Paper
Fly Ribbon
Fly Stick
Fly Swatter
Fly Trap
Fresh Cab Rodent Repellent
Fruit Fly Trap
Giant Destroyer Garlic Repellent Clips Deer & Rabbit

Harris Diatomaceous Earth
Harris Famous Roach Tablets
Harris Neem Oil
Harris Roach Traps
Havahart Live Animal Cage Trap
Insect Sticky Traps
Jobe's Fertilizer Spikes
Jobe's Organic Fertilizer

Jobe's Organic Fertilizer Spikes
JT Eaton Kills Bed Bugs Powder
Liquid Fence Animal Repellent
Liquid Fence Deer & Rabbit
Liquid Fence Snake Repellent
Live Catch Mouse Trap
Messina's Animal Stopper
Messina's Deer Stopper
Messina's Rodent Stopper
Messina's Squirrel Stopper
Miracle Gro Performance Organics
Mole Trap
Mole X
Monterey 70% Neem Oil
Monterey Bt
Monterey Fish & Guano
Monterey Fruit Tree Spray Plus
Monterey Garden Insect Spray
Monterey Horticultural Oil
Monterey Liqui-Cop
Monterey Neem Oil
Monterey Take Down Garden Spray
Mosquito Bits
Mosquito Dunks
Moss Out! Roofs & Walks
Mouse Traps
Mouse X
Mouse Zero
Natria Grass & Weed Control
Natria Insect, Disease, & Mite Control
Natria Insecticidal Soap
Natria Neem Oil
Natria Rose & Flower
Natria Snail & Slug Killer Bait
Nature's Care Organic Fertilizer
Neem Oil
Orange Guard
Organocide Bee Safe 3 in 1 Garden Spray
Ortho 3 in 1 Insect, Mite, & Disease
Ortho Bed Bug Traps
Ortho Deer B Gon
Ortho GroundClear Weed & Grass
Ortho Home Defense Ant & Roach Killer w/ Essential Oils
Ortho Home Defense Crawling Bug Killer w/ Essential Oils
Ortho Home Defense Flying Bug Killer w/ Essential Oils
Ortho Insect Killer Tree & Shrub
Osmocote
Owl Garden Defense
Pulverize Weed & Grass Killer
Pulverize Weed Killer for Lawns
Pulverize Weed, Brush & Vine Killer
Raid Ant Baits III
Raid Essentials Ant & Roach
Raid Essentials Ant, Spider, & Roach
Raid Small Roach Baits
Rat Traps
Rat X
Rat Zero
Rescue Ant Baits
Rescue Fly Trap
Rescue Fly Trap Refill
Rescue Fly TrapStik
Rescue Pantry & Birdseed Moth Traps
Rescue WHY Trap
Rescue WHY Trap Refills
Rescue Yellowjacket Trap
Rescue Yellowjacket Trap Cartridge
Rescue Yellowjacket Trap Refill
Safer 3 in 1
Safer Ant & Crawling Insect Killer
Safer Caterpillar Killer
Safer Critter Ridder Animal Repellent
Safer Critter Ridder Deer & Rabbit
Safer Diatomaceous Earth
Safer End ALL
Safer Garden Dust
Safer Garden Fungicide
Safer Houseplant Sticky Stakes
Safer Insect Killing Soap
Safer Moss & Algae Killer
Safer Neem Oil
Safer Pantry Pest Trap
Safer Rose & Flower
Safer Snake Shield
Safer Tomato & Vegetable
Safer Yellowjacket & Wasp Attractant
Safer Yellowjacket & Wasp Trap
Scarecrow
Scott's Continuous Release Fertilizer
Scotts Moss EX
Scram for Cats
Sevin Sulfur Dust
Shake Away Rodent Repellent
Slug Trap
Sluggo
Sluggo Plus
Soil Moist
St. Gabriel Moss Killer

Stay Away Ants
Stay Away Mice
Stay Away Moths
Stay Away Spider
Tanglefoot
Terro Ant Killer Liquid
Terro Clothes Moth Alert
Terro Flea Trap
Terro Fly Magnet
Terro Fruit Fly Trap
Terro Indoor Fly Trap
Terro Liquid Ant Bait
Terro Moth Traps
Terro Multi-Purpose Insect Bait
Terro Multi-Surface Liquid Ant Bait
Terro Outdoor Liquid Ant Bait
Terro Roach Magnet
Terro Wasp & Fly Trap
Tom Cat Animal Repellent
Tom Cat Attractant Gel
Tom Cat Deer Repellent
Tom Cat Mouse Traps
Tom Cat Rat Traps
Tom Cat Rodent Repellent
Victor Black Box Gopher Trap
Victor Electronic Mouse Trap
Victor Electronic Rat Trap
Victor Fly Magnet
Victor Mole & Gopher Repellent
Victor Mole Trap
Victor Mouse Traps
Victor Mouse-A-Way Mouse Repellent
Victor Natural Rodent Repeller Packs
Victor Rat Traps
Victor Rat Zapper
Victor Rat-A-Way Rat & Mouse Repellent
Victor Tin Cat Mouse Trap
Whitney Farms Lawn Weed Killer
Whitney Farms Organic Fertilizer
Whitney Farms Weed & Grass Control
Window Fly Trap
Yard Enforcer Sprinkler

2022
Pesticide Annual Report and Effectiveness Assessment

California Stormwater Quality Association

Final Report

August 2022

CALIFORNIA STORMWATER QUALITY ASSOCIATION®

Preface

The California Stormwater Quality Association (CASQA) is comprised of stormwater quality management organizations and individuals, including cities, counties, federal agencies, state agencies, ports, universities and school districts, wastewater agencies, water suppliers, special districts, industries, and consulting firms throughout California. CASQA's membership provides stormwater quality management services to more than 26 million people in California.

This report provides CASQA's members with focused information on its efforts to prevent pesticide pollution in urban waterways. It is a component of CASQA's True Source Control Initiative, which seeks to address stormwater and urban runoff pollutants at their sources. This report was funded by CASQA, Alameda Countywide Clean Water Program, Contra Costa Clean Water Program, Fairfield-Suisun Urban Runoff Management Program, Marin County Stormwater Pollution Prevention Program, Napa Countywide Stormwater Pollution Prevention Program, Sacramento Stormwater Quality Partnership, San Mateo Countywide Water Pollution Prevention Program, Santa Clara Valley Urban Runoff Pollution Prevention Program, Sonoma County Water Agency, and Vallejo Flood & Wastewater District.

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Abbreviations Used in this Report

BACWA – Bay Area Clean Water Agencies

BO – Biological Opinion

CASQA – California Stormwater Quality Association

CEQA – California Environmental Quality Act

CWA – Clean Water Act

DPR – California Department of Pesticide Regulation

EMPM – Environmental Monitoring Public Meeting

EPA – United States Environmental Protection Agency

ESA – Endangered Species Act

FIFRA – Federal Insecticide, Fungicide, and Rodenticide Act

IPM – Integrated Pest Management

MAA – Management Agency Agreement between DPR and the Water Boards

MS4 – Municipal Separate Storm Sewer System

NACWA – National Association of Clean Water Agencies

NPDES – National Pollutant Discharge Elimination System

OPP – U.S. EPA Office of Pesticide Programs

OW – U.S. EPA Office of Water

PAH – Polycyclic aromatic hydrocarbon

PEAIP – Program Effectiveness Assessment and Improvement Plan

PID – Proposed Interim Decision

PMAC – Pest Management Advisory Committee

PPDC – EPA's Pesticide Program Dialogue Committee

SFBRWQCB – San Francisco Bay Regional Water Quality Control Board

SPM – Sustainable Pest Management Work Group (DPR)

STORMS – Strategy to Optimize Resource Management of Storm Water (a program of the State Water Board)

SWAMP – California Water Boards Surface Water Ambient Monitoring Program

TMDL – Total Maximum Daily Load (regulatory plan for solving a water pollution problem)

TSC – CASQA True Source Control Subcommittee

UP3 – Urban Pesticides Pollution Prevention Partnership

UPA – Urban Pesticide Amendments

USGS – U.S. Geological Survey

Water Boards – California State Water Resources Control Board together with the California Regional Water Quality Control Boards

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Executive Summary

This report by the True Source Control (TSC) Subcommittee of the California Stormwater Quality Association (CASQA) describes CASQA's activities related to the goal of preventing pesticide pollution in urban waterways for the period of July 2021 through June 2022.

To address the problems caused by pesticides in California's urban waterways, CASQA collaborates with the California State Water Resources Control Board and the California Regional Water Quality Control Boards (Water Boards). By working with the Water Boards and other water quality organizations, we address the impacts of pesticides efficiently and proactively through the statutory authority of the California Department of Pesticide Regulation (DPR) and EPA's Office of Pesticide Programs (OPP). More than 18 years of collaboration with Urban Pesticides Pollution Prevention (UP3) Partnership, as well as EPA and DPR staff, has resulted in significant changes in pesticide regulation. A summary of CASQA's activities to address key management questions are described below, with more details and outcomes provided in Section 2.

Near term / Current problems – Are actions being taken by State and Federal pesticides regulators and stakeholders that are expected to end pesticide-caused toxicity or exceedances of pesticide water quality objectives in surface waters receiving urban runoff?

- CASQA shared its urban runoff expertise with pesticide regulators by preparing comment letters to EPA for eight pesticide reviews, providing the Water Boards and other partners with information that triggered additional letters on one pesticide. *(See Table 3 and Appendix C.)*
- CASQA and partners successfully lobbied the federal General Services Administration (GSA) to return functionality and transparency to the Regulations.Gov website, the public access point for federal agency rulemaking including EPA pesticide dockets.
- In response to requests from CASQA and partners, EPA proposed enhanced label language for pyrethrins.
- To mitigate risks to aquatic organisms and human health, EPA proposed substantial mitigation measures for the herbicide, oxyfluorfen.
- CASQA updated the Pesticide Watch List based on new EPA registrations and the State's update to the 303(d) list. The Watch List will be shared with pesticides regulators and with government agency and university scientists to stimulate generation of surface water monitoring and aquatic toxicity data for the highest priority pesticides. *(See Table 2.)*

Long term / Prevent future problems – Do pesticides regulators have an effective system in place to exercise their regulatory authorities to prevent pesticide toxicity in urban water bodies?

- DPR continues to demonstrate its commitment to addressing pesticide impacts on receiving waters through timely mitigation and implementation of improved evaluation procedures.
- The State Water Board continued to work toward development of the Urban Pesticide Amendments (UPA). The desired outcome for these amendments is to institutionalize the State's strategy of utilizing pesticide regulations as the primary mechanism for addressing pesticide water quality problems associated with urban runoff. In spring 2022, CASQA met with State Water Board staff to provide potential options for evaluating the effectiveness of the UPAs in addressing MS4 pesticide discharges, to support identification of compliance pathway options for municipal stormwater permits.
- To support the UPA, the State Water Board continued to work toward establishing a coordinated urban runoff monitoring program intended to coordinate with existing Water Board and DPR urban pesticides and toxicity monitoring programs. The State Water Board continued to draft a proposed monitoring program and expects to present a document for public comment in spring 2023. CASQA remains dedicated to supporting State Water Board staff.

- In 2022, the EPA published a workplan to address the incorporation of their Endangered Species Act (ESA) obligation with pesticide registrations and re-registrations.
- Although many improvements have been made by EPA OPP since the early 2000s, improvement in scientific evaluations supporting EPA OPP's regulatory efforts and better understanding of urban runoff management systems are still necessary to adequately protect urban surface waters from pesticide impairments. The regulatory climate recently improved at the federal level and we will continue to work with EPA OPP to further our goals.
- In June, CASQA spoke at EPA's Environmental Monitoring Public Meeting to convey the importance of including urban uses in ESA mitigations, emphasizing that such mitigations are feasible and cost-effective.
- In spring 2022, Dave Tamayo, a longtime TSC member and recent retiree from Sacramento County, was appointed to EPA's Pesticide Program Dialog Committee (PPDC) representing an important opportunity to enhance urban stormwater discussions at the federal level. CASQA subsequently designated r Mr. Tamayo as CASQA's official representative at the PPDC.

In the coming year, CASQA plans to continue to address near-term pesticide concerns and seek long-term regulatory change. Future near-term and long-term tasks are identified in Section 3, Tables 5 and 6. Key topics include:

- Continued support of the eventual completion and adoption of the UPAs by the State Water Board;
- Continued development of a coordinated monitoring program in partnership with the Water Boards, DPR, and EPA Region 9;
- Registration review-related activities at EPA for pyrethroids and fipronil;
- Initiating discussion of urban water quality concerns at the EPA PPDC's future meetings;
- DPR registration applications and proposed decisions for new products.

Section 1. Introduction

1.1 IMPORTANCE OF CASQA'S EFFORTS TO IMPROVE PESTICIDE REGULATION

For decades, the uses of certain pesticides in urban areas – even when applied in compliance with pesticide regulations – have adversely impacted urban water bodies. Currently used pesticides are the primary cause of toxicity in California surface waters, including urban water bodies.[1] Under the Clean Water Act (CWA), when pesticides impact water bodies, local agencies may be held responsible for exceedances in surface waters, as well as costly monitoring and mitigation efforts. To date, some California municipalities[2] have incurred substantial costs to comply with pesticides-related Total Maximum Daily Loads (TMDLs) and additional permit requirements. In some cases (e.g., diazinon, chlorpyrifos), municipal compliance costs have continued more than a decade after termination of virtually all urban use. In the future, more municipalities throughout the state are expected to be subject to similar requirements, as additional TMDLs and Basin Plan Amendments are adopted (Table 1). Meanwhile, local agencies have no authority to restrict or regulate when or how pesticides are used[3] in order to proactively prevent pesticide pollution and avoid these costs and liabilities.

Under federal and state statutes, EPA and DPR have the authority and responsibility to regulate pesticides and protect water bodies from adverse effects (including impacts from pesticides in urban runoff). Unfortunately, until the relatively recent past, these agencies did not recognize the need, nor possess the institutional capacity, to exercise their authority to protect urban water quality. As a result, past registration actions have allowed a number of pesticides (such as pyrethroids and fipronil) to be used legally in ways that have resulted in widespread pollution in urban water bodies. This situation is depicted in Figure 1.

To change this situation, CASQA is actively engaged with state and federal regulators in an effort to develop an effective pesticide regulatory system, based primarily on existing statutes, that includes timely identification and mitigation of urban water quality impacts, and proactively prevents additional problems through the registration and registration review processes (Figure 2).

New Pesticide 303(d) Listings and Delistings Approved in 2022

In January 2022, the State Water Board adopted the 2020-2022 Integrated Report for which the Central Coast, Central Valley and San Diego Regions were scheduled for on-cycle 303(d) reviews. The report was subsequently submitted to and approved by EPA.

Listings: The report included numerous additional 303(d) pesticide listings for all three regions. While the most common listings were for pyrethroids (either specific individual pesticides or the overall pyrethroid group), other listings include imidacloprid, fipronil and diuron. Dichlorvos was also added for an urban creek in San Diego and Bensulide (an organophosphate pesticide) was added for an urban/rural mixed region in Monterey County.

Delistings: The report included 38 delistings from the 303(d) list, most of which were diazinon (urban uses already prohibited) and chlorpyrifos (no meaningful urban uses). Notably, organophosphate pesticides were delisted for an urban waterway in Sacramento and two urban waterways in Stockton due to attaining water quality standards.

(State Water Board's 2020-2022 Integrated Report, May 11, 2022).

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[1] See reports from the California Surface Water Ambient Monitoring Program Sediment Pollution Trends Program including Anderson, B.S., Hunt, J.W., Markewicz, D., Larsen, K., 2011. Toxicity in California Waters, Surface Water Ambient Monitoring Program. California Water Resources Control Board. Sacramento, CA.

[2] For example, Sacramento-area municipalities spent more than $75,000 in the 2008-2013 permit term on pyrethroid pesticide monitoring alone; Riverside-area municipalities spent $617,000 from 2007 to 2013 on pyrethroid pesticide chemical and toxicity monitoring.

[3] Local agencies in California have authority over their own use of pesticides but are pre-empted by state law from regulating pesticide use by consumers and businesses.

Table 1. California TMDLs, Statewide Water Quality Control Plans, and Basin Plan Amendments Addressing Currently Registered Pesticides and/or Toxicity in Urban Watersheds[4, 5, 6]

Water Board Region	Water Body	Pesticide	Status
Statewide	All MS4s/All Urban Waterways: Statewide Water Quality Control Plan amendments for urban pesticides reduction ["Urban Pesticides Amendments"] (Inland Surface Waters, Enclosed Bays & Estuaries, and Ocean)	All Pesticides/All pesticide-related toxicity	In preparation
	Sediment Quality Objectives (Enclosed Bays & Estuaries)	Sediment Toxicity [7]	Approved
	Toxicity Provisions (Inland Surface Waters and Enclosed Bays & Estuaries)	Toxicity [7]	Adopted by State; awaiting EPA approval [8]
San Francisco Bay (2)	All Bay Area Urban Creeks	All Pesticide-Related Toxicity	Approved
Central Coast (3)	Santa Maria River Watershed	Pyrethroids, Toxicity	Approved
	Lower Salinas River Watershed	Pyrethroids, Toxicity	Approved
		Malathion, Chlorpyrifos, Diazinon [9]	Adopted by Central Coast Water Board, June 2022 [10]
	San Lorenzo River Watershed (Santa Cruz)	Chlorpyrifos [9]	Approved
Los Angeles (4)	Marina del Rey Harbor	Copper (Marine antifouling paint) [11]	Approved
	Oxnard Drain 3 (Ventura County)	Bifenthrin, Toxicity	EPA-Adopted Technical TMDL
	Calleguas Creek, its Tributaries and Mugu Lagoon	Water & Sediment Toxicity [7] Diazinon & Chlorpyrifos [9]	Approved
	McGrath Lake (Ventura County)	Sediment Toxicity [7]	Approved
	Colorado Lagoon (Long Beach)	Sediment Toxicity [7]	Approved
	Dominguez Channel; Greater Los Angeles & Long Beach Harbor	Sediment Toxicity [7]	Approved
	Ballona Creek Estuary	Sediment Toxicity [7]	Approved

4 Excludes pesticides that are not currently registered in California, such as organochlorine pesticides.
5 https://www.waterboards.ca.gov/water_issues/programs/tmdl/
6 https://www.waterboards.ca.gov/water_issues/programs/tmdl/2020_2022state_ir_reports_final/apx_d_adopted_tmdls_list.pdf
7 These TMDLs/Plan provisions can trigger toxicity testing stressor source identification studies, and additional follow up, even when toxicity is linked to current pesticides.
8 https://www.waterboards.ca.gov/water_issues/programs/state_implementation_policy/tx_ass_cntrl.html
9 Use prohibited in urban areas (diazinon) or no meaningful use due to use limitations (chlorpyrifos).
10 https://www.waterboards.ca.gov/centralcoast/board_info/agendas/2022/jun/item8_att1a.pdf
11 Primarily addresses pesticides that are directly discharged and should not ordinarily appear in stormwater (marine antifouling paint).

Water Board Region	Water Body	Pesticide	Status
Central Valley (5)	Sacramento River and San Joaquin River Basins	Pyrethroids	Approved
	Sacramento-San Joaquin River Delta Waterways	Diazinon & Chlorpyrifos [9]	Approved
	Sacramento & Feather Rivers	Diazinon & Chlorpyrifos [9]	Approved
	Sacramento County Urban Creeks	Diazinon & Chlorpyrifos [9]	Approved
	Lower San Joaquin River	Diazinon & Chlorpyrifos [9]	Approved
Lahontan (6)	Pesticide Discharge Prohibition	All Pesticides	Approved
Santa Ana (8)	Newport Bay	Copper (Marine antifouling paint) [11]	In preparation [12]
	San Diego Creek, and Upper and Lower Newport Bay	Toxicity (Diazinon & Chlorpyrifos) [9]	EPA-Adopted Technical TMDL
San Diego (9)	Shelter Island Yacht Basin (San Diego Bay)	Copper (Marine antifouling paint) [11]	Approved
	Chollas Creek	Diazinon [9]	Approved

[12] https://www.newportbeachca.gov/government/departments/public-works/ocean-water-quality/newport-bay-copper

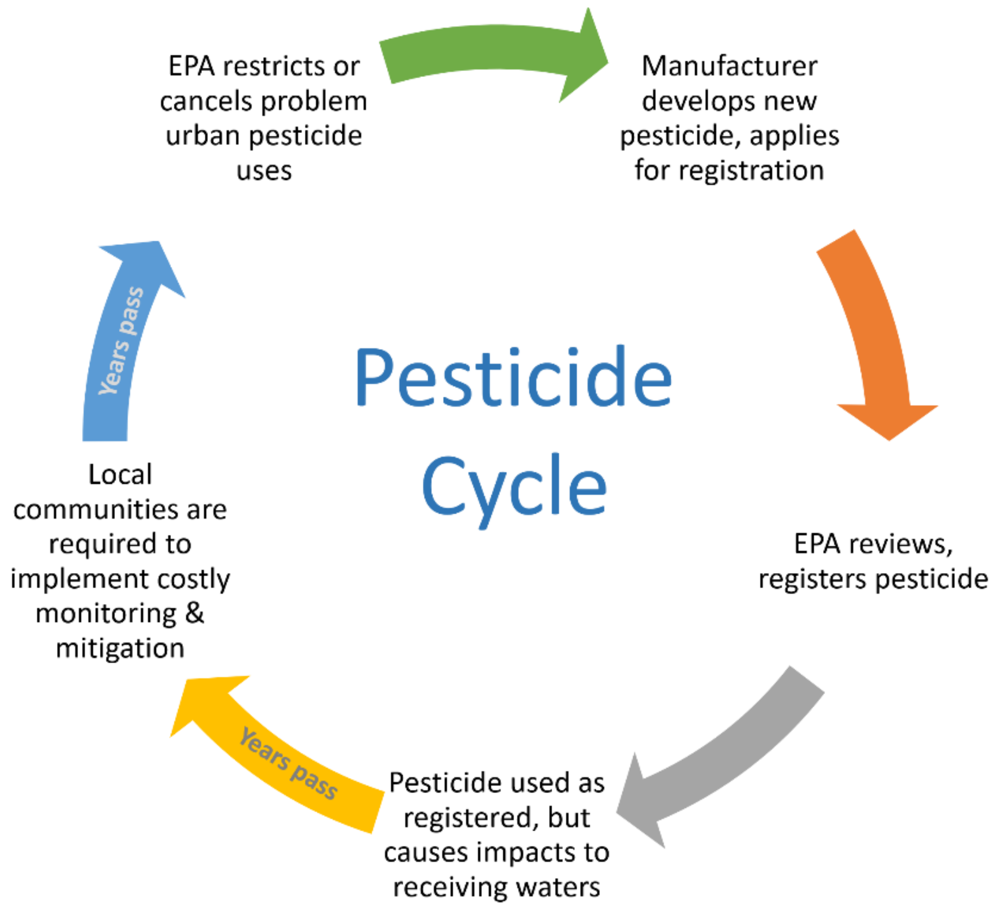


Figure 1. The Pesticide Regulatory System Can Lead to Harmful Outcomes to Surface Waters, Proving Costly to Municipalities.

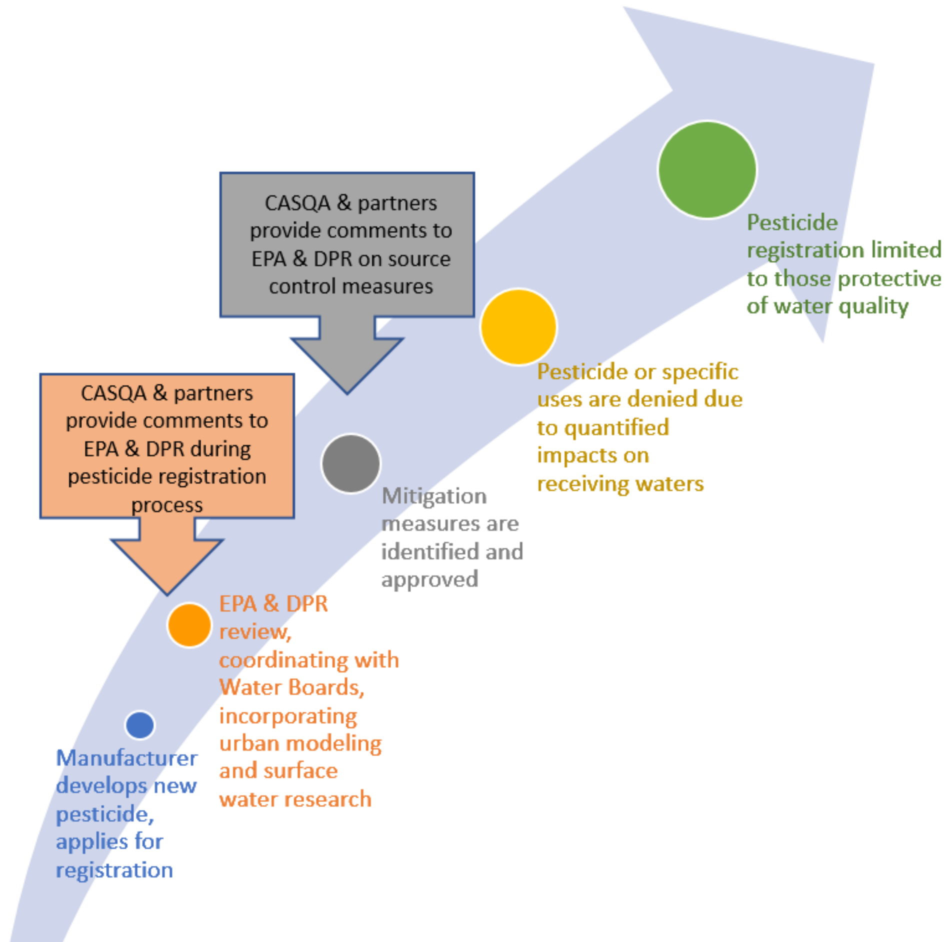


Figure 2. Via Proactive Use of the Pesticide Regulatory Structure, CASQA and Partners Seek to Restrict Pesticide Uses that have the Potential to Cause Urban Water Quality Problems.

1.2 CASQA'S GOALS AND APPLICATION TO PROGRAM EFFECTIVENESS ASSESSMENT

CASQA's *Vision for Stormwater*, first approved by the Board of Directors in 2015, is periodically updated to reflect developments in stormwater management. In October 2020, CASQA released the updated *Vision for Sustainable Stormwater Management*.[13] Within CASQA's Vision, Action 1.2 is to "Minimize Pollution Through True Source Control." Among the objectives described within Action 1.2, Objective 2 has the following scope:

> **Objective 2: Implement an Urban Pesticide Program**
>
> For decades now, the uses of certain pesticides in urban areas – even when applied in compliance with pesticide regulations – have adversely impacted urban water bodies. Currently used pesticides are the primary cause of toxicity in California surface waters, including urban water bodies. CASQA is actively engaged with state and federal regulators in an effort to develop an effective pesticide regulatory system, based primarily on existing statutes, that includes timely identification and mitigation of urban water quality impacts, and proactively prevents additional problems through the registration and registration review processes.
>
> Potential Collaborators: State Water Board, DTSC, EPA, DPR

The effectiveness of CASQA's efforts toward this scope can be expressed in relation to management questions established as part of Municipal Separate Storm Sewer Systems' (MS4s') program effectiveness assessments that are required in some MS4 permits. With respect to addressing urban pesticide impacts on water quality, the following two management questions are suggested for inclusion in MS4s' program effectiveness assessment:

Question 1: (Near term / Current problems) – Are actions being taken by State and Federal pesticides regulators and stakeholders that are expected to end recently observed pesticide-caused toxicity or exceedances of pesticide water quality objectives in surface waters receiving urban runoff?

Question 2: (Long term / Prevent future problems) – Do pesticides regulators have an effective system in place to exercise their regulatory authorities to prevent pesticide toxicity in urban water bodies?

This report is organized to answer these management questions and is intended to support annual permit compliance requirements for both Phase I and Phase II MS4s. It describes the year's status and progress, provides detail on stakeholder actions (by CASQA and others); and provides a roadmap / timeline showing the context of prior actions as well as anticipated end goal of these activities. This report may also be used as an element of future effectiveness assessment annual reporting.

[13] https://www.casqa.org/sites/default/files/downloads/final_-_vision_for_sustainable_stormwater_management_-_10-07-2020.pdf

Section 2. Latest Results of CASQA Efforts

At any given time, there are dozens of pesticides with current or pending actions from the EPA or DPR. Addressing near term regulatory concerns is important because some pesticides may pose immediate threat to water quality that can lead to compliance liability for MS4s, and because some of the regulatory decisions made by EPA and DPR will last many years. For example, pesticide registration decisions are intended to be revisited on a fifteen-year cycle. To inform its engagement on near-term regulatory concerns, CASQA uses the Pesticide Watch List in the prioritization of near-term efforts (Section 2.1).

Meanwhile, CASQA and BACWA continue to work on parallel efforts to effect long-term systemic changes in the regulatory process itself (see inset). By identifying inadequacies and inefficiencies in the pesticide regulatory process, and persistently working with EPA and DPR to improve the overall system of regulating pesticides, CASQA and BACWA are gradually achieving results (Section 2.2).

CASQA and BACWA Continue to Coordinate Monitoring EPA and DPR Pesticide Regulatory Actions

There has been a long history of collaboration between CASQA, the Bay Area Clean Water Agencies (BACWA), and the State Water Board, as all entities seek to track and respond to pesticide regulatory actions, with the goal of avoiding pesticide-related toxicity.

CASQA and BACWA regularly track pesticide regulatory activities by EPA, DPR and other agencies. In 2021, CASQA and BACWA combined resources to track stormwater and wastewater priorities into a single Action Plan, updated monthly.

Together, CASQA and BACWA accomplish tasks that are impractical for individual member agencies. Both CASQA and BACWA are committed to continued collaborations to streamline our proactive regulatory approach. In 2022, a factsheet was developed to help member agencies understand the importance of this coordinated effort. (See Appendix A.)

2.1 NEAR-TERM REGULATORY CONCERNS

CASQA seeks to ensure that the Water Boards and EPA's Office of Water (OW) work with DPR and EPA's OPP to manage problem pesticides that are creating near-term water quality impairments. These efforts address CASQA Vision Action 1.2 as well as Phase II MS4 Program Effectiveness Assessment and Improvement Plan (PEAIP) Management Question 1 regarding observed pesticide-caused toxicity or exceedances of pesticide water quality objectives in surface waters receiving urban runoff.

Assessment Question 1: (Near term / Current problems) – Are actions being taken by State and Federal pesticides regulators and stakeholders that are expected to end recently observed pesticide-caused toxicity or exceedances of pesticide water quality objectives in surface waters receiving urban runoff?

Answer: As detailed below, at the State level, significant progress has been made by DPR in addressing near-term and current problems with pesticides in surface waters receiving urban runoff. DPR continues to implement improved registration processes and responses to observed water quality problems. DPR also continues to implement and evaluate mitigation measures for observed problems with pyrethroids and fipronil.

At the Federal level, less progress has been made at addressing near term problems. Some early actions were taken to address pyrethroid and fipronil problems at the urging of CASQA and DPR. However, EPA does not show a clear understanding of key urban uses in its analyses, and it is still unclear if its upcoming risk management decisions for pyrethroids, fipronil, and imidacloprid and other neonicotinoids will provide any additional protection of urban water bodies.

2.1.1 Updated Pesticide Watch List

A key tool for identifying near-term regulatory concerns is CASQA's Pesticide Watch List. As time permits, CASQA reviews scientific literature, government reports, and monitoring studies as they are published. This information is used to prioritize pesticides based on the most up-to-date understanding of urban uses, pesticide characteristics, monitoring, and surface water quality toxicity (for pesticides and their degradates). CASQA uses these insights to update the list each year (Table 2), which serves as a management tool to help focus efforts on the most important pesticides from the perspective of MS4 agencies.[14] There are two upgrades in priority from 2021 to 2022. Dichlorvos is the basis for one new impairment in the most recent 303(d) list (spring 2022), moving it from Priority 4 to Priority 3. Naled, registered for mosquito abatements, degrades to dichlorvos (DDVP) post-application and remains at levels toxic to aquatic organisms; therefore it too has been upgraded to Priority 3. Bensulide (an organophosphate pesticide) was added as a Priority 3 due to the new 303(d) listing for an urban/rural mixed waterbody in Salinas. Bensulide has urban herbicide uses for landscaping and golf courses, is highly toxic to freshwater invertebrates, very highly toxic to marine and estuary invertebrates, and frequently sold in products in combination with oxadiazon (Priority 4 on the Watch List). There are a number of antimicrobial pesticides under review by EPA for uses in outdoor paints and coatings, the leaching of which can lead to water quality impacts; CASQA anticipates adding such pesticides to the Watch List in the coming months.

2.1.2 Description of Near-Term Regulatory Processes

Immediate pesticide concerns may arise from regulatory processes undertaken at DPR or EPA's OPP. For example, when EPA receives an application to register a new pesticide, there may be two opportunities for public comment that are noticed in the Federal Register, as depicted in green in Figure 3. EPA's process usually takes less than a year while DPR typically evaluates new pesticides or major new uses of active ingredients within 120 days.

Table 2. Current Pesticide Watch List (July 2022)

Priority	Basis for Priority Assignment	Pesticides		
1	Monitoring data exceeding benchmarks; linked to toxicity in surface waters; urban 303(d) listings	Pyrethroids (20 chemicals[15])	Fipronil	Imidacloprid Malathion
2	Monitoring data approaching benchmarks; modeling predicts benchmark exceedances; very high toxicity and broadcast application on impervious surfaces; urban 303(d) listing for pesticide, degradate, or contaminant that also has non-pesticide sources	Carbendazim (Thiophanate methyl)[16] Chlorantraniliprole Copper pesticides +	Creosote (PAHs) Indoxacarb Neonicotinoids (other than Imidacloprid)[17] Pendimethalin	Pesticides with dioxins impurity[18] PHMB + Zinc pesticides (including Ziram) +
3	Pesticide contains a Clean Water Act Priority Pollutant; 303(d) listing for pesticide, degradate, or contaminant in watershed that is not exclusively urban	Arsenic pesticides Bensulide	Diuron Naled Naphthenates	Simazine Silver pesticides + Trifluralin

[14] The first Watch List was published by the UP3 in 2005.

[15] Allethrins, Bifenthrin, Cyfluthrin, Cyhalothrin, Cypermethrin, Cyphenothrin, Deltamethrin, Esfenvalerate, Etofenprox, Flumethrin, Imiprothrin, Metofluthrin, Momfluothrin, Permethrin, Prallethrin, Resmethrin, Sumethrin [d-Phenothrin], Tau-Fluvalinate, Tetramethrin, Tralomethrin.

[16] Carbendazim is a registered pesticide, and also a degradate of thiophanate-methyl

[17] Acetamiprid, Clothianidin, Dinotefuran, Thiamethoxam (degrades into Clothianidin)

[18] 2,4,-D, Chlorothalonil, Dacthal, Pentachlorophenol

+ *Used in pools, spas, and/or fountains*

Priority	Basis for Priority Assignment	Pesticides		
		Chromium pesticides Dichlorvos (DDVP)		
4	High or unknown toxicity (parent or degradate) and urban use pattern associated with water pollution; synergist for higher tier pesticide; on DPR priority list	Abamectin ADBAC pesticides[19] + Antimicrobials in paints/coatings Azoxystrobin Bacillus sphaericus + Bacillus thuringiensis + Bromacil N-Bromosulfamates Busan-77 + Carbaryl Chlorinated isocyanurates+ Chlorine + Chlorine dioxide + Chlorfenapyr Chlorsulfuron DCOIT + DDAC +	Dichlobenil Dithiopyr Halohydantoins + Hydramethylnon Hypochlorites + Imazapyr Isoxaben Mancozeb Methomyl Methoprene + Methyl anthranilate + Mineral bases, weak + Mineral oil (aliphatic) + MGK-264 Novaluron Oryzalin Oxadiazon Oxyfluorfen	PCNB Peroxyacetic acid + Phenoxy herbicides[20] Piperonyl butoxide (PBO) Prodiamine Propiconazole Pyrethrins Pyriproxyfen + Sodium bromide + Sodium chlorite + Sodium percarbonate + Sodium tetraborate + Spinosad + / Spinetoram Sulfometuron-methyl Tebuconazole Terbuthylazine + Triclopyr Triclosan Trimethoxysilyl quats
5	Frequent questions from partners	Chloropyrifos (near zero urban use)	Diazinon (no urban use) Glyphosate	Metaldehyde
New	Priority determined on the basis of proposed urban use, aquatic toxicity, and other information in registration application.	Not known but may include the following:	Cyantraniliprole Cyclaniliprole Flupyradifurone	Nitenpyram (Neonic) Nithiazine (Neonic) Sulfoxaflor (Neonic)
None	Based on review of available data, no approved urban use or no tracking trigger as yet identified.	Most of the >1,000 existing pesticides		
Unknown	Lack of information. No systematic screening has been completed for the complete suite of urban pesticides.	Unknown		

[19] Alkyl Dimethyl Benzyl Ammonium Chlorides (ADBAC) includes a family of 21 different quaternary ammonium pesticides.
[20] MCPA and salts, 2,4-D, 2,4-DP, MCPP, dicamba

Figure 3. EPA's Registration Process for New Pesticides

Another regulatory process, "Registration Review," depicted in Figure 4, is meant to evaluate currently registered pesticides about every 15 years, to account for new data available since initial registration. In general, it takes EPA five to eight years to complete the entire process. In addition to this process, pesticides are typically evaluated based on Endangered Species Act criteria. EPA regularly updates its schedule for approximately 50 pesticides that will begin the review process in a given year.[21]

Figure 4. EPA's Registration Review – Process to Review Registered Pesticides at a Minimum of Every 15 Years.

DPR also has an ongoing, but informal review process (called continuous evaluation) that can address pesticides water pollution. If it needs to obtain data from manufacturers, DPR can initiate a formal action, called "Reevaluation." These evaluations, mitigation measure development, and mitigation effectiveness evaluation have involved ongoing communication with CASQA and partners.

While EPA must consider water quality in all of its pesticide registration decisions, at DPR this step is not yet fully established as standard (most outdoor urban pesticide registration applications are routinely routed by DPR for surface water review, but a few – notably antimicrobial products used in storm drains – do not automatically receive this review). CASQA monitors registration applications, to identify those relevant to urban runoff, based on the Pesticide Watch List in Table 2 and use pattern/toxicity analysis for pesticides that have not previously been reviewed.

2.1.3 Key Near-Term Regulatory Activities and Progress

Table 3 presents a summary of recent CASQA and partner activities to address near-term regulatory concerns and the latest results; for additional insight regarding on-going pesticide registrations, see Appendix C. CASQA monitors the Federal Register and DPR's website for notices of regulatory actions related to new pesticide registrations and registration reviews. This includes monitoring EPA's dockets via the website Regulations.Gov which had lost functionality during the previous administration and was recently restored thanks to CASQA and partners (see inset on next page). Since the Pesticide Watch List is not based on a comprehensive review of all pesticides, CASQA watches for additional pesticides that appear to have any of the following characteristics: proposed urban, outdoor uses with direct pathways for discharge to storm drains, high aquatic toxicity, or containing a priority pollutant. Participating in these regulatory processes can take many years to complete.

In addition, EPA's OPP strives to update their Aquatic Life Benchmarks table on an annual basis.[22] In August 2021, EPA's Office of Pesticide Programs, Environmental Fate and Effects Division updated its pesticides Aquatic Life Benchmarks table.[18] These updates included benchmarks for 9 newly registered

[21] See https://www.epa.gov/pesticide-reevaluation/registration-review-schedules for schedule information.
[22] https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/aquatic-life-benchmarks-and-ecological-risk

pesticides (and their degradates) and 81 previously registered pesticides (and their degradates) undergoing registration review. This included updates for 26 pesticides (and 16 associated degradates) on CASQA's Pesticide Watch List. Among those were the following CASQA Priority 1 pesticides:

- Fipronil
- Three fipronil degradates
- Eleven individual pyrethroids
    - Bifenthrin
    - Beta-Cyfluthrin
    - Cyfluthrin
    - Gamma-Cyhalothrin
    - Lambda-Cyhalothrin
    - Alpha-Cypermethrin
    - Beta-Cypermethrin,
    - Cypermethrin,
    - Deltamethrin
    - Esfenvalerate
    - Permethrin

CASQA and Partners Succeed in Returning Transparency to EPA's Pesticide Dockets

The federal General Services Administration (GSA) operates the website Regulations.Gov. The website has long been the primary public access point for federal agency rulemaking "e-dockets" and their contents, such as proposed and final rules, supporting data, and public comments. Despite its historical limitations, the website maintained e-docket information in a way that was organized and reasonably accessible to interested parties.

Beginning around 2019, the website began to be altered in such a way that it impaired CASQA's ability to interact with EPA pesticide dockets, including the ability to search for and receive information and to post comments. Among the issues impacting CASQA's ability to engage with EPA's dockets were as follows:

- **Subscription Service Termination:** The subscription services feature was essential to CASQA and countless interested parties attempting to track changes in federal rules and regulations. Subscribing to a docket has been the only reasonably efficient way to know when EPA posts something on the docket.
- **Search Non-Functional:** The previous version of the Regulations.Gov site was easy to search; the new version's search engine did not provide any results.
- **User Interface:** The user interface hid prior comments and obfuscated access to all documents in the dockets.

In May 2021 the Democracy Forward Foundation and eight other public interest organizations submitted a letter to GSA describing concerns with the website. This opened the door to additional comment letters from CASQA, BACWA, and the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB). Subsequently, GSA invited CASQA and partners to online meetings in September 2021 and March 2022. During that time GSA made the following progress:

- **Subscription Services Restored:** GSA restored email subscriptions for updates on a specified docket.
- **User Interface:** One-stop access to all posted comments for a given docket.

CASQA continues to coordinate with GSA lead staff as they continue to make improvements and restore prior features. Their attention to our concerns this past year was encouraging.

Table 3. Latest Results of Efforts Communicating Near-Term Regulatory Concerns to EPA[23]

Regulatory Action or Concern	CASQA Efforts			Partner Support (Letters)	Outcomes and notes
	Letter(s)	Call(s) or emails	Mtg(s)		
Cyhalothrins Proposed Interim Decision (PID)	✓			BACWA	***Partial Success.*** In the PID, EPA concluded that outdoor / urban uses present substantial risks to freshwater and estuarine/marine fish and invertebrates. As mitigation, EPA proposed label language changes. CASQA sought enhancements to the proposed label language to include a graphic to prevent spilling or dumping into storm drains, to provide clear and consistent language regarding impervious and vertical surfaces, and provide California-specific labels for outdoor structural pest control. No such requests were granted. (See Appendix C for details.)
Pyrethroids and Pyrethrins Risk Mitigation Proposal for 23 Chemicals	✓			BACWA SFBRWQCB NACWA	CASQA noted that the risk/benefits should differentiate between the 23 chemicals and among the various outdoor uses. CASQA further argued that EPA should ban outdoor uses of bifenthrin. In a subsequent PID only for pyrethrins (not pyrethroids), EPA responded that their analysis was adequate and that *"bifenthrin is not outstanding among pyrethroids in terms of risk quotient exceedances, aquatic invertebrate toxicity, or environmental persistence."*
Permethrin Draft Risk Assessment (Antimicrobial Uses)	✓				CASQA questioned the assumption that "exposure to aquatic areas from terrestrial uses is expected to be negligible," and recommended modeling scenarios for existing terrestrial wood preservative uses – specifically fences and decks. EPA responded that the chemical parameters for permethrin suggest the leaching rate for those scenarios would lead to negligible exposure. EPA also referenced a 2020 document that indicates permethrin is not intended for such uses despite the fact that there are labeled permethrin-containing products for such uses. (See Appendix Cfor details.)
Malathion National Marine Fisheries Service ESA Biological Opinion (BO)	✓				CASQA sought significant mitigation measures such as restricting malathion use in non-agricultural settings to professional applicators and restricting urban applications to avoid impervious surfaces. While the BO includes significant language to limit application on impervious surfaces, the language only applies within 300 meters of ESA-listed species habitats. (See Appendix C for details.)

[23] Color coding in this table is meant to reflect the Pesticide Watch List prioritization color coding in Table 2.

Regulatory Action or Concern	CASQA Efforts			Partner Support (Letters)	Outcomes and notes
	Letter(s)	Call(s) or emails	Mtg(s)		
Chlorothalonil Draft Ecological Risk Assessment (Antimicrobial Uses)	✓				***Pending.*** Asked that EPA perform surface water modeling for urban uses that were omitted from the Risk Assessment including commercial, industrial, and residential outdoor uses. For the uses EPA did include in the analysis (turf and nurseries), EPA concluded that the fungicide is highly toxic to freshwater and estuarine/marine fish, freshwater and estuarine/marine invertebrates, and amphibians. On that basis, CASQA requested that EPA (1) develop a comprehensive mitigation program to reduce potential negative impacts to aquatic organisms from non-agricultural uses, particularly those uses involving antimicrobial protection for building materials and (2) prioritize mitigation measures that reduce the transport of chlorothalonil to urban runoff.
Ziram Ecological Risk Assessment and Proposed Interim Decision	✓				***Partial Success.*** For freshwater invertebrates, EPA cited several reasons why the calculated risks were likely to be overestimates leading to a conclusion that appeared to be speculative and arbitrary, the results of which may not be sufficiently protective of aquatic life. Therefore, CASQA asked that EPA modify its risk assessment analysis for freshwater invertebrates. In addition, CASQA requested that the risk assessment be amended to include consideration of the results of a sediment toxicity study for freshwater invertebrates. In the subsequent PID, EPA agreed that additional analysis would be beneficial but that the analysis is no longer needed. Due to human health effects, **EPA is proposing cancellation of the paint preservative uses of ziram as well as additional controls for non-paint materials preservative uses of ziram.** CASQA submitted a subsequent letter supporting product cancelations and controls. (See Appendix C for details.)
Creosote Proposed Interim Decision	✓				EPA's Decision was made without the benefit of an Ecological Risk Assessment. This was due to a lack of data despite multiple data requests by EPA to the registrants (dating back to 2011). Therefore, CASQA asked that an Ecological Risk Assessment be completed before publishing a registration review decision. EPA responded that they did not want to delay registration review to await ecological data given the need for mitigation for worker protection. CASQA further requested that EPA seek monitoring data given that PAHs found in creosote are commonly detected in urban runoff and receiving waters. EPA concurred that PAHs are common but that the registered upstream sources are so varied so as not to allow a correlation between creosote uses and PAH pollution. (See Appendix C for details.)

Regulatory Action or Concern	CASQA Efforts			Partner Support (Letters)	Outcomes and notes
	Letter(s)	Call(s) or emails	Mtg(s)		
Diuron Ecological Risk Assessment; Diuron Antimicrobial Use Risk Assessment and PID	✓				***Partial Success.*** CASQA sought consistency in toxicity endpoints within EPA documentation. EPA concurred that the endpoints were inconsistent between the two risk assessments and that would be addressed in the amended Ecological Risk Assessment. CASQA requested that the risk assessment be amended to include sediment toxicity study for freshwater invertebrates. EPA noted that because they are cancelling all conventional herbicidal uses, such studies are not warranted. CASQA countered that such studies are still necessary due to the antimicrobial uses. (See Appendix C for details.)
Oxadiazon Draft Risk Assessment	✓				***Partial Success.*** CASQA supported the termination of specific uses in the Draft Risk Assessment; some of which were removed from the subsequent PID. A prohibition of liquid applications is among the mitigations still in place in the PID. (See Appendix C for details.)
Pyrethrins PID	✓			BACWA SFBRWQCB NACWA	***Success!*** CASQA recommended that the label language be updated to include water protection statements, definitions of spot-treatments, a reduction in height of building treatments (from 3 feet to 2 feet), weather prohibitions (rain and/or wind events), and a Spanish translation for the outdoor drain discharge prohibition. EPA concurred with these suggestions. CASQA also recommended that EPA include an outdoor drain graphic. The EPA responded that *"outdoor and agricultural product labels already have label statements to prevent these chemicals from reaching drainage systems."* Instead, EPA added an indoor drain graphic which is still a valuable addition.(See Appendix C for details.)

2.2 LONG-TERM CHANGE IN THE PESTICIDES REGULATORY STRUCTURE

Since the mid-1990s, CASQA (and its predecessor organization the Storm Water Quality Task Force), have worked toward a future in which the pesticide regulatory structure at the state and federal level proactively restricts pesticide uses that have the potential to cause urban water quality problems. These efforts directly relate to Phase II MS4 PEAIP Management Question 2.

Assessment Question 2. (Long term / Prevent future problems) – Do pesticides regulators have an effective system in place to exercise their regulatory authorities to prevent pesticide toxicity in urban water bodies?

Answer: Improvements in processes at EPA and especially at DPR have moved closer to that future. Many of these improvements are linked to the persistent work of CASQA and partners to educate regulators on how previous process deficiencies did not adequately address urban pesticide problems.

As detailed below, at the State level, significant progress has been made by DPR and the Water Boards in establishing a comprehensive statewide approach to utilizing pesticide regulatory authorities to prevent pesticide toxicity in urban water bodies. Overall, DPR has a system in place that is reasonably effective at addressing pesticide toxicity in urban water bodies, although improvement is needed to better coordinate this process with the requirements of the Clean Water Act and NPDES MS4 permits. DPR and the Water Board, along with CASQA and other stakeholders, are working diligently to strengthen this system and to institutionalize it. The goal is to embody this process in the State's UPAs and the Management Agency Agreement (MAA) between DPR and the State Water Board.

At the Federal level, OPP has implemented some improvements in how it evaluates and responds to water quality problems associated with pesticides, but it does not yet do this reliably and does not have a system in place to ensure that this will happen consistently and adequately. Meanwhile, scientific studies are being conducted by USGS and EPA's Office of Research and Development to better understand the complexities of pollution in urban stormwater. In addition, another EPA branch, the Office of Chemical Safety and Pollution Prevention (OCSPP), tasked their Pesticide Programs staff with improving the integration of the EPA and Services implementation of the Endangered Species Act.

2.2.1 Focus on EPA's Federal Endangered Species Act

In April 2022, EPA published their "first-ever comprehensive workplan to address the decades-old challenge of protecting endangered species from pesticides." [24] The workplan presents a vision and four strategies to approach this challenging effort to protect endangered species while protecting public health (see callout box at right).[25]

CASQA communicated directly with OCSPP's Deputy Assistant Administrator for Pesticide Programs to advance the importance of urban stormwater uses and the need for mitigations to clearly tie to risk analysis findings, targeting specific uses and products.

- *Strategy 1: Meet ESA Obligations for FIFRA Actions*
- *Strategy 2: Improve Approaches to ESA Mitigation*
- *Strategy 3: Improve Interagency Consultation Process*
- *Strategy 4: Improve Stakeholder Engagement*

[24] https://www.epa.gov/newsreleases/epa-announces-plan-protect-endangered-species-and-support-sustainable-agriculture

[25] For complete document see https://www.epa.gov/system/files/documents/2022-04/balancing-wildlife-protection-and-responsible-pesticide-use_final.pdf.

In addition, in June, EPA hosted an Environmental Monitoring Public Meeting (EMPM), the focus of which was the Endangered Species Act and solutions to avoid, minimize or offset potential effects from pesticides to endangered and threatened species and designated critical habitats. CASQA representatives prepared an abstract (see inset) and was subsequently invited to speak. More than 200 participants, including staff from OCSPP Pesticide Programs, convened for the online meeting.

The primary message CASQArepresentatives conveyed was that practical ESA mitigations specific to urban users are necessary, feasible, and cost-effective. CASQA's presence at the meeting was key, given that other presenters represented registrants and agricultural users. CASQA was the single presentation to make connections between urban uses and endangered species. The presentation included numerous examples of effective mitigations, including DPR's strict limitations to structural use of fipronil by licensed, trained users. The presenters concluded with the following:

- Endangered species are exposed to pesticides used in urban areas via wastewater and urban runoff;
- Desktop studies and modeling can identify and prioritize specific urban pesticide uses for mitigation actions;
- Advanced treatment of pesticides in wastewater and urban runoff is not a feasible mitigation strategy;
- Pesticide label changes are only effective for licensed & trained users; and
- Sale and use restrictions most effective mitigation option for products designed for unlicensed/untrained pesticide users.

CASQA sought to educate all participants, particularly EPA staff, that these mitigations cannot be initiated at the local level and thus require EPA to enact these source control measures (See Appendix B).

CASQA Representatives Invited to Present at EPA's **Environmental Modeling Public Meeting (EMPM) – Topic: Endangered Species Assessment**, **June 23, 2022**

Tammy Qualls, M.S., P.E (Qualls Environmental Consulting); Kelly Moran, Ph.D (San Francisco Estuary Ins
Stephanie Hughes, M.S., P.E. (Santa Clara University); and Armand Ruby, M.S. (Armand Ruby Consulting).

Abstract: *State water regulators are required to ensure compliance with the Endangered Species Act (ESA) via authority allocated by the Clean Water Act (CWA) under the NPDES permit program. Local agencies must comply with the NPDES program. Since they cannot regulate the use and sale of pesticides in their local area, they have had to develop practical measures to avoid, minimize, or offset chemicals of concern. Advanced treatment of pesticides in wastewater and stormwater is costly and often unfeasible. Local agencies have instead focused on targeted mitigation of specific chemicals at their source. Source control has led to reduced concentrations of chemicals at publicly owned treatment works (POTWs) and in stormwater. The State of California Department of Pesticide Regulation (CA-DPR) has performed modeling of specific label language changes for the pesticide fipronil to evaluate how changing the width of the application spray or the frequency of application can alter the concentration of fipronil in surface water. This type of modeling of changes in label language allows CA-DPR to focus mitigations on quantifiable results that minimize the impact to aquatic life.*

2.2.2 Focus on California's Urban Pesticides Amendments (UPA)

In 2014 the State Water Board made a strategically important decision to institutionalize its commitment to work closely with DPR and EPA to utilize pesticide regulatory authority as the primary mechanism for preventing and responding to impairments of receiving waters linked to current use pesticides in urban runoff.

To accomplish this goal, the State Water Board established an urban pesticides reduction project (now titled the Urban Pesticides Amendments or UPA) as a top priority project under the comprehensive stormwater strategy it adopted in December 2015, known as “Strategy to Optimize Resource Management of Storm Water” or STORMS.[26] CASQA representatives have been participating actively in the development of the Urban Pesticide Amendments since their inception.

The State Water Board continues to work towards developing the UPA which may be developed as separate, standalone policy or, be incorporated into the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries, and the Water Quality Control Plan for Ocean Waters of California (once it is established). In mid-2019, DPR and the State Water Board signed a major update to their formal MAA that memorializes their existing systems and growing cooperation and lays out the steps they are taking toward a “unified and cooperative program to protect water quality related to the use of pesticides.” The State Water Board STORMS staff indicate that communication with DPR staff regarding the UPAs has been enhanced by the MAA and that the two agencies meet regularly.

CASQA continues to work closely with STORMS staff on the UPA as an effective path to solving urban toxicity and to support urban stormwater capture and use. In 2022, STORMS staff held several meetings with stakeholders, including CASQA representatives.. CASQA provided the STORMS staff with input regarding potential options for evaluating the effectiveness of the UPA in addressing MS4 pesticide discharges to support identification of compliance pathway options for municipal stormwater permits. STORMS staff presented at the October 2021 CASQA conference, and a STORMS staff member typically attends each TSC meeting, providing updates and accepting feedback.

According to STORMS staff, a draft UPA is expected to be issued and available for comment in spring 2023.

2.2.3 CASQA Participation in Federal and State Advisory Groups

As presented in Table 4, CASQA remains actively involved with various agencies and advisory groups that affect pesticide use and pest management in urban areas. CASQA’s long-time state-level leadership is now complemented by a new federal opportunity (see inset at right).

Urban Stormwater Representation at OPP

In 2022, Dave Tamayo, was appointed to the EPA’s Pesticide Program Dialogue Committee (PPDC), on which he previously served from 2010 to 2016. Mr. Tamayo is a long time member of the TSC subcommittee and CASQA and recently retired from Sacramento County. Mr. Tamayo has been approved by the CASQA Board as its official representative to this committee. The 40-person committee, chaired by the Director of OPP, includes representatives from growers, industry, environmental, public health, farmworkers, as well as state/local/tribal government. This is expected to be an important opportunity to include urban stormwater concerns in federal level dialogue. Mr. Tamayo has placed urban pesticide concerns on the PPDC’s list of potential future agenda items.

[26] STORMS' overall mission is to “lead the evolution of storm water management in California by advancing the perspective that storm water is a valuable resource, supporting policies for collaborative watershed-level storm water management and pollution prevention, removing obstacles to funding, developing resources, and integrating regulatory and non-regulatory interests.” (http://www.waterboards.ca.gov/water_issues/programs/stormwater/storms/)

Table 4. Participation in Federal and State Efforts to Support CASQA's Goals

Agency or Conference	Latest Outcomes
EPA's Pesticide Program Dialogue Committee (PPDC)	The PPDC holds biannual public meetings. At the May 2022 meeting, key CASQA topics included: • A discussion of label reform, including digitization and standardization; • An update on the Endangered Species Act Workplan by the Deputy Assistant Administrator for Pesticide Programs for Office of Chemical Safety and Pollution Prevention.
DPR's Pest Management Advisory Committee (PMAC)	Participation on the PMAC has resulted in expanded focus by DPR on urban pest management and water quality issues and generated funding for urban IPM research and implementation programs.
DPR's Sustainable Pest Management Work Group (SPM)	DPR formed this work group in 2021. The goal of the SPM is "to develop a recommended roadmap with ambitious, measurable goals to practically achieve the state's vision to accelerate a system-wide transition to safer, more sustainable pest management."[27] Two CASQA members serve as invited members of the Urban Subgroup of the SPM. Formal release of the SPM draft roadmap for public comment is expected to occur later in 2022.

[27] https://www.cdpr.ca.gov/docs/pestmgt/sustainable_pest_management_workgroup.htm

Section 3. CASQA's Approach Looking Ahead

At any given time, EPA and DPR may be in the process of evaluating and registering various pesticides for urban use. CASQA will continue to track and engage in EPA and DPR activities, with a focus on top priority active ingredients (as identified in the annual Pesticide Watch List) and sharing relevant urban runoff information and CASQA's water-quality specific expertise with pesticides regulators. Key documents to be reviewed will include risk assessments and risk management proposals with an eye toward ensuring that pesticide regulators have and consider accurate information on relevant factors in urban areas such as pesticide use patterns, urban pollutant transport mechanisms, and receiving water conditions. CASQA strives to ensure that pesticide regulators have access to relevant information such as monitoring data, water quality regulatory requirements, and urban runoff agency compliance liabilities and cost information. As necessary, CASQA will continue to recommend changes in an individual pesticide's allowable uses or use instructions, request consideration of impacts on water bodies receiving urban runoff, and/or ask that regulators fill critical data gaps by obtaining more data from manufacturers. As resources allow and circumstances warrant, CASQA will continue to collaborate with wastewater organizations (such as BACWA), other water quality stakeholders, and the Water Boards in commenting on EPA and DPR actions.

In the coming year, CASQA will continue to address near-term pesticide concerns and seek long-term regulatory change. Although changes at the federal level are important for fully achieving CASQA's goal of protecting water quality through the effective use of pesticide regulations, until there is a more favorable situation at that level, we will continue to focus our efforts on solidifying progress at the state level. In the coming year, CASQA will continue engagement on specific regulatory actions for priority pesticides at the federal level, while continuing the strategic focus on supporting State adoption of the UPAs. CASQA's current priority activities are as follows:

(1) Continue collaboration with DPR to address near-term regulatory concerns, while seeking OPP and OW actions to reduce inconsistencies:

- Ensure DPR action on fipronil water pollution is completed, including effective professional user education about restrictions on its outdoor urban use.
- Ensure DPR enforces mitigation measures for pyrethroids and fipronil, and adopts additional measures as necessary.
- Ensure the state continues to conduct surveillance monitoring to evaluate pyrethroids and fipronil mitigation effectiveness and to evaluate occurrence of new threats like imidacloprid and other neonicotinoid insecticides.
- Continue to encourage EPA to complete scientific groundwork and to identify and implement pyrethroids, fipronil, malathion, and imidacloprid mitigation measures, recognizing that it is likely that necessary mitigation cannot readily be implemented entirely by DPR.

(2) 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 to adopt the statewide UPA. Through this process, CASQA will work with other stakeholders to implement the planned restructuring of California's urban surface water pesticides monitoring to increase its effectiveness and improve coordination.
- Encourage and assist the Water Board to continue to implement its MAA with DPR and increase its leadership role in preventing and mitigating pesticide impairments through more effective pesticide regulation at the state and federal level.
- Seek procedure changes such that DPR continues to refine its registration procedures to address remaining gaps in water quality protection.
- Seek increased transparency of DPR regulatory activities, including timely access to scientific evaluation reports that are the basis of registration decisions.

CASQA will continue to seek opportunities to coordinate on high priority regulatory actions, with the Water Boards and other water quality stakeholders such as POTWs and non-profits, to take advantage of efficiencies, increase effectiveness, and ensure that the water quality community has a consistent message. Table 5 presents CASQA's activities anticipated for the coming year; CASQA will conduct these activities as priorities indicate and resources allow. Table 6 summarizes upcoming regulatory action items that are likely to proceed and may require CASQA attention in the coming year.

Table 5. CASQA Pesticide Activities

Activity		Purpose
Regulatory Tracking	Track Federal Register notices	Identify regulatory actions for high priority active ingredients that may require review.
	Track DPR notices of registration applications and decisions	Identify pesticides meriting surface water review that are not within DPR's automatic routing procedures, identify gaps or potential urban runoff-related problems with current DPR evaluation or registration plans other regulations, procedures, and policies.
	Track activities at the Water Boards	Identify opportunities for improvements in TMDLs, Basin Plan Amendments, and permits.
	Review regulatory actions, guidance documents, and work plans	Identify potential urban runoff-related problems with current EPA evaluation or registration plans, other regulations, procedures, and policies.
Regulatory Communications	Briefing phone calls, informal in-person meetings, teleconference meetings, and emails with EPA and DPR	Information sharing about immediate issues or ongoing efforts; educate EPA and DPR about issues confronting water quality community. Provide early communication on upcoming proceedings that help reduce the need for time-intensive letters.
	Convene formal meetings, write letters, and track responses to letters	Ensure current pesticide evaluation or registration process accurately addresses urban runoff and urban pesticide use and management contexts. Take advantage of opportunities to formally provide information and suggest more robust approaches that could be used in future regulatory processes. Request and maintain communication on mitigation actions addressing highest priority pesticides.
Advisory	Serve on EPA, DPR, and Water Board policy and scientific advisory committees	Provide information and identify data needs and collaboration opportunities toward development of constructive approaches for managing pesticides.
Educational	Presentations to and informal discussions with EPA, DPR, Water Board, CASQA members,	Educate EPA, DPR, Water Board, and CASQA members about the urban runoff-related shortcomings of existing pesticide regulatory process, educational efforts to support process improvements, and report on achievements. Encourage research and monitoring programs to address urban runoff data needs and priorities. Stimulate academic, government, or private development of analytical and toxicity identification methods to address anticipated urban runoff monitoring needs. Inform development of new pesticides by manufacturers and selection of pesticides by professional users.
	Develop and deliver public testimony	Educate Water Board members about the problems with existing pesticide regulatory process, encourage change, and report on achievements.

Activity		Purpose
Monitoring and Science	Update Pesticide Watch List based on new scientific and regulatory information	The Pesticide Watch List (Table 2) serves as a management tool to prioritize and track pesticides used outdoors in urban areas.
	Data analysis of DPR/SWAMP/USGS/MS4 monitoring, pesticide use data, and information from scientific literature	Summarize data to educate CASQA members and water quality community, Water Boards, DPR, and EPA.
Reporting	Prepare Monthly Action Plans	Coordinate CASQA's regulatory actions with partners
	Prepare Annual Report to describe the year's status and progress, provide detail on stakeholder actions, and the context of prior actions as well as anticipated end goal of these activities.	Provide CASQA's members with focused information on its efforts to prevent pesticide pollution in urban waterways. The document serves annual compliance submittal for both Phase I and Phase II MS4s. It may also be used as an element of PEAIPs and future effectiveness assessment annual reporting.

Table 6. Anticipated Upcoming Opportunities for Pesticides Regulatory Engagement

EPA Pesticide Registration Review (15-year cycle) (organized chronologically by anticipated next regulatory step) [28]			
Priority	**Topic**	**Item**	**Urban Runoff Concern**
unknown	New Antimicrobials	various	Varied; many of these pesticides are showing up for the first time at the PID level; review is needed to screen these for water quality issues
1	Fipronil	PID	Monitoring data; Anticipated 303(d) listings
2	Dacthal (DCPA)	RA	303(d) listings (dacthal, dioxins); Contains CWA Priority Pollutants (dioxins)
3	Sodium pyrithione	PID	Paint additive
4	Dicamba	RA	Phenoxy herbicide
1	Etofenprox	PID	Pyrethroid
2	Thiophanate methyl/ Carbendazim (MBC)	PID	Degradate toxicity, use patterns
4	2,4-D	PID	Phenoxy herbicide

[28] RA = Risk Assessment; PID = Proposed Interim Decision

4	Carbaryl	PID	Toxicity; monitoring data
4	Tebuconazole	PID	Fungicide
4	Chlorothalonil	PID	Central Valley Water Board high relative risk; 303(d) listings (dioxins); Contains CWA Priority Pollutant (Dioxins); DPR monitoring priority
4	Mancozeb	PID	Central Valley Water Board high relative risk
4	PCNB	PID	Dioxin impurity
4	Peroxy Compounds (peroxyacetic acid)	PID	Fountain chemical
2	Copper HDO	PID	303(d) listings (copper); TMDLs (copper); Contains CWA Priority Pollutant (Copper)
4	ADBAC group	RA	Antimicrobial
4	DDAC group	RA	Pool chemical
4	Isothiazolinones (includes DCOIT, BBIT, BIT, MIT, OIT)	RA	Antimicrobials. Uses include paints.

Other EPA-related Items

- U.S. EPA "Increasing Consistency and Transparency in Considering Costs and Benefits in the Rulemaking Process" affects how the U.S. EPA uses cost and benefit analysis in setting pollution standards. Rule proposal was expected in 5/19.
- Proposed rule to eliminate some OPP Federal Register Notices (was anticipated September 2018 according to U.S. EPA semi-annual regulatory agenda)
- U.S. EPA Update to Guidelines for Deriving Aquatic Life Water Quality Criteria. Draft scoping document external peer review is next step. Seeking OPP engagement.

DPR New Pesticide Product Registration Decisions

New Product Applications (Active ingredient – product name)	Why tracking	Current Status
1R-Phenothrin - by MGK	Outdoor uses	Noted on EPA docket. Not yet in DPR Notice.
Tetraniliprole	Outdoor uses	Noted on EPA docket. Not yet in DPR Notice.
Momfluorothrin (and Phenothrin) - S-1563	New urban pyrethroid	2014: DPR confirmed that Surface Water would review.
Momfluorothrin (and Cypermethrin) - MGK Products	New urban pyrethroid	2014: DPR confirmed that Surface Water would review.
Alpha-cypermethrin - Fendona CS	New urban pyrethroid	2018: DPR confirmed that Surface Water would review.

Transfluthrin - Bayer Product	New urban pyrethroid. Indoor and outdoor uses	Noted on EPA docket. Not yet in DPR Notice.
Fipronil and Bifenthrin - Taurus Trio G	Landscaping product	2017: DPR confirmed that Surface Water would review.
Fipronil - Termidor HP II	Termite product	2018: DPR confirmed that Surface Water would review.
Fipronil - MGK Formula 3115	Outdoor yellow jacket product	2019: DPR confirmed that Surface Water would review. 7/9/21: Notice of Final Decision posted. Product limited to bait stations.
Bifenthrin, Novaluron, and pyriproxyfen - Duraflex CS	Use on non-residential sites	2019: DPR confirmed that Surface Water would review.
Indoxacarb - Doxem Precise	New aerated indoxacarb powder	2019: DPR confirmed that Surface Water would review.
Zinc, Thiabendazole and 2-pyridinethiol-1-oxide – Ultra-Fresh DW-30	Potential use in vehicle tires	DPR is asking the registrant of that product that should not have been approved for use in rubber to change the product label to again say "not for use in California" with regard to the use in rubber.
Fipronil – Imidacloprid: Fuse Foam by Control Solutions, Inc.	Indoor/outdoor fipronil-imidacloprid foam	BACWA/CASQA have been tracking this product since 2017. 7/2/2021: DPR issues notice to deny, noting several problems with the label. 5/27/2022: DPR confirmed that the label that they are reviewing is the same as the label available on the EPA website.
Bifenthrin / Acetamiprid F9228-2 RTU insecticide / miticide by FMC	Outdoor and indoor uses. Label allows liberal spraying.	1/5/2022: DPR confirmed that the Surface Water Group would review.

Other DPR-related Items

- Registration Application Surface Water Reviews – continue to follow up on communications requesting review of all storm drain products and outdoor antimicrobials

Water Boards

- ***State Water Board Urban Pesticides Amendments*****.** State Water Board workshop/public comment period and decision expected in 2023.
- Pesticides 303(d) listings
- Pesticide TMDL implementation requirements for permittees

Other Statewide Items

- ***DPR Sustainable Pest Management Workgroup.***. Workgroup has the goal of establishing measurable goals to achieve the state's vision of safer, more sustainable pest management. A subgroup is focusing on urban pesticides. The public will have opportunity to comment once the draft workplan is released in Summer 2022.
- ***California Department of Food & Agriculture Program EIR on invasive species*** control covering potential broadcast pesticide applications urban areas of multiple priority pesticides. **October 2021 update**: California's Court of Appeal has ruled that a statewide pesticide-spraying program violates the law by failing to study and minimize the threats from pesticides and to properly inform the public about the risks of spraying. The ruling noted that the department did not analyze or disclose the health and environmental harms of the more than 75 pesticides. The court decision also noted a lack of public notice. Furthermore, they did not evaluate local impacts or allow opportunity for affected communities to opt out. **June 2022 Update:** New ruling by Sacramento County Superior Court orders the state to halt spraying.

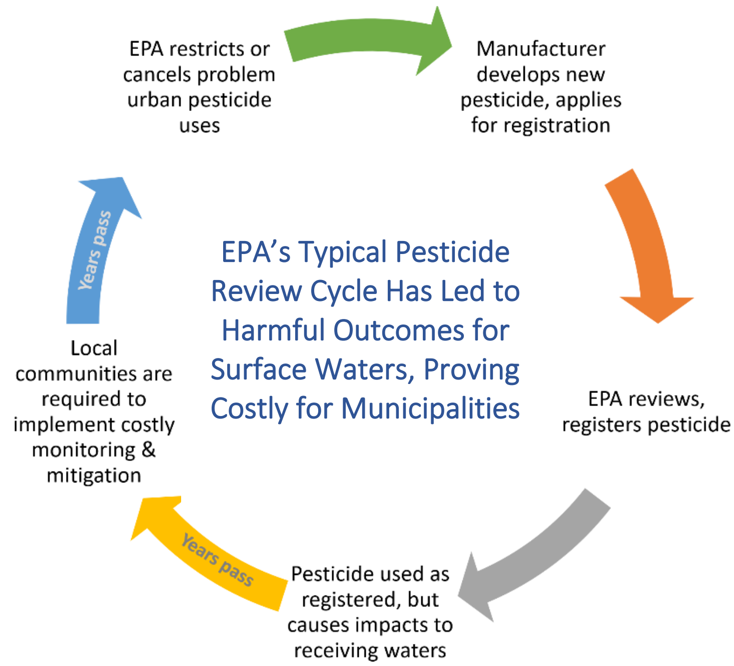
Appendix A

CASQA / BACWA Fact Sheet

BACWA and CASQA Have Effectively Collaborated to Reduce Urban Pesticide Pollution Since 2011

Urban Pesticides Threaten Ecosystem Health in California Watersheds

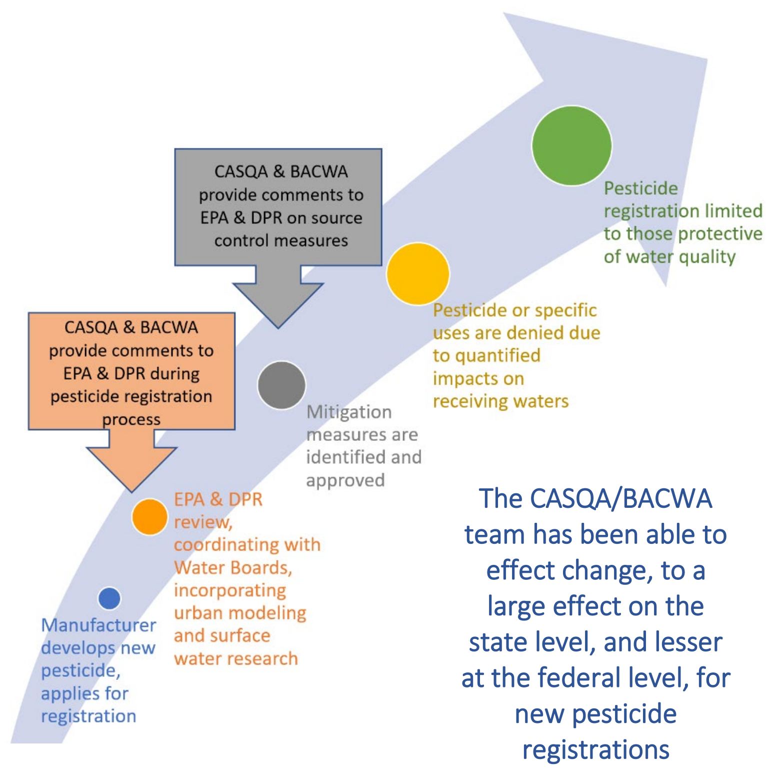
Pesticides including insecticides, herbicides, antimicrobials, fungicides, and rodenticides are a threat to aquatic ecosystems when they reach waterways through wastewater and stormwater. The Clean Water Act holds local agencies responsible for pollutant toxicity (including pesticides) in surface water, including the cost of monitoring and mitigation. Agencies also face substantial costs to comply with pesticides-related Total Maximum Daily Loads (TMDLs), Basin Plan Amendments, California State Water Board Toxicity Provisions, and additional permit requirements. Compliance costs for public agencies can continue years after a pesticide is banned (e.g. diazinon, chlorpyrifos) as the pesticides can remain in the aquatic environment long after they are used.



Unfortunately, local agencies only have authority over their own use of pesticides; they are pre-empted by state law from regulating pesticide sales or use by consumers and businesses. Instead, pesticides are regulated by the United States Environmental Protection Agency (EPA) and the California Department of Pesticides Regulation (DPR), which in some cases have not adequately protected urban discharges and water bodies from toxicity. Several pesticides are present in urban water bodies throughout California at concentrations above aquatic toxicity thresholds.[1]

CASQA and BACWA Provide Input to EPA and DPR at Crucial Intersections

Since 2011, BACWA and CASQA have collaborated to educate EPA and DPR staff regarding wastewater and urban stormwater obligations. Such collaborations require information sharing, coordination of communications with pesticide regulators, and contributing staff time and other resources in support of the shared goal. Both organizations coordinate with the State and Regional Water Boards (Water Boards) to address the impacts of pesticides efficiently and proactively through the statutory authority of DPR and EPA. Furthermore, we share our findings with other partner agencies and stakeholders so that our voices are magnified.[2]



[1] California Integrated Report (Clean Water Act Section 303(d) List and 305(b) Report) https://www.waterboards.ca.gov/water_issues/programs/water_quality_assessment/2020_2022_integrated_report.html
[2] Partners include National Association of Clean Water Agencies and National Municipal Stormwater Alliance.

CASQA and BACWA Accomplish Tasks that are Impractical for Individual Member Agencies

Since local agencies cannot locally regulate pesticides, BACWA and CASQA work to reduce pesticides in the aquatic environment by:

- **Educating Regulators Regarding Wastewater and Urban Stormwater Issues**. Half of all pesticide use occurs in urban areas, yet pesticides work at EPA is largely focused on agricultural uses. We educate EPA on the impacts of indoor and outdoor urban uses, and call attention to the pesticide-related challenges facing local public agencies.
- **Tracking and Prioritizing Pesticide Regulatory Action.** We use a multifaceted method for pesticide tracking and action, with the goal of reducing the impact of priority pesticides on the aquatic environment.
- **Sharing Science.** CASQA and BACWA share new scientific studies and monitoring data with EPA and DPR, essential to science-based regulation.
- **Identifying Data Gaps and Faulty Assumptions.** Due to its agricultural focus, EPA frequently omits key outdoor uses or indoor sources with direct paths to the sewer. EPA's pesticide use assumptions are sometimes incongruent with known use practices in California. Omitting key urban uses and associated aquatic risks prevents regulatory actions that would reduce toxicity in wastewater and stormwater.
- **Analyzing Monitoring Data**. We review urban watershed and POTW effluent monitoring data to identify pesticides that are exceeding or approaching aquatic toxicity thresholds.
- **Recommending Source Control Strategies to Prevent Harm.** Once EPA identifies potential for harm to aquatic organisms, it is open to discuss source control alternatives (which EPA refers to as mitigation) to prevent such harm. At that point we identify and recommend source control measures that could reduce such impacts.

Working Together, BACWA and CASQA Get Results

- **Through our cross-agency collaboration, DPR has improved pesticide registration.** DPR now has permanent stormwater and wastewater monitoring programs, and a permanent process to protect both stormwater and wastewater when new pesticides are registered.[3]
- **We offer unique insights.** Without CASQA and BACWA on the pulse of DPR and EPA's data analysis and modeling, the only feedback might be from manufacturers unaware of the regulatory and water quality challenges posed by their products.
- **BACWA/CASQA feedback has led to improved assessments and improved source control**:
    - EPA improved label language for hundreds of pyrethroid products, including a pictogram provided by a BACWA member agency (at right) (stormwater and wastewater)
    - DPR adopted pyrethroids regulations, including restrictions on outdoor residential use (stormwater)
    - DPR adopted fipronil restrictions that are expected to reduce fipronil in urban runoff more than 90 percent (stormwater)
    - EPA labeling requirements that protect urban water quality are consistently being required for pool and spa treatments (stormwater and wastewater)
    - EPA developed root control chemical POTW notification requirements (wastewater)
    - DPR required manufacturers to fund the POTW pyrethroids survey, providing monitoring data necessary for EPA's first-ever POTW-specific detailed evaluation in its Pyrethroids Registration Review (wastewater)
    - EPA improved evaluations for hydramethylnon, which resulted in label language mitigations: environmental hazards, rain advisory, and avoidance of broadcast applications on impervious surfaces (stormwater)

This Work Remains Essential

CASQA and BACWA have spent more than a decade seeking restrictions for the highest priority pesticides. The pesticides review process—driven by EPA—often lasts more than a decade, with each pesticide open for re-registration every 15 years. California does not have a periodic review process. While our actions may take years to see results, these tasks demonstrate our effort to influence State and federal regulators to adequately protect California's urban waterways.

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[3] Water Quality Impairments Due to Aquatic Life Pesticide Toxicity: Prevention and Mitigation in California, USA, Kelly Moran, Brian Anderson, Bryn Phillips, Yuzhou Luo, Nan Singhasemanon, Richard Breuer, Dawit Tadesse, *Environ Toxicol Chem* 2020;39:953–966. https://setac.onlinelibrary.wiley.com/doi/abs/10.1002/etc.4699

Appendix B: CASQA / BACWA Presentation at EPA Environmental Monitoring Public Meeting

Practical measures and mitigations to reduce pesticide effects on endangered and threatened species in urban areas

Tammy Qualls, M.S., P.E (Qualls Environmental Consulting); Kelly Moran, Ph.D. (San Francisco Estuary Institute); Stephanie Hughes, M.S., P.E. (Santa Clara University); and Armand Ruby, M.S. (Armand Ruby Consulting).

Our work on this topic is funded by the Bay Area Clean Water Agencies and the California Stormwater Quality Association

BACWA BAY AREA CLEAN WATER AGENCIES

CASQA

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Qualls Environmental Consulting
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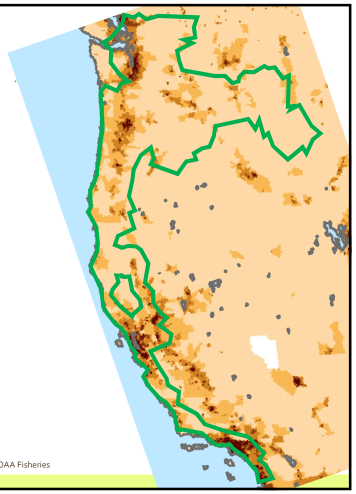
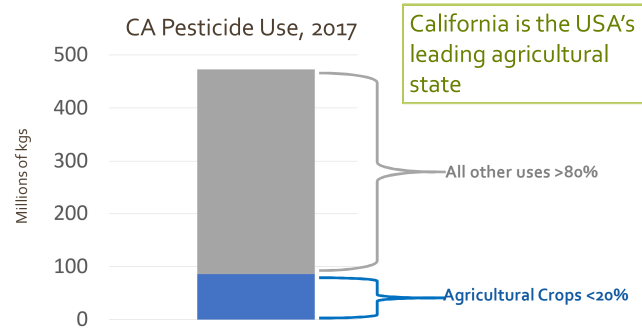
Endangered species habitat often overlaps with urban areas: **salmon example**

- Map shows urban areas on west coast of USA
- Darker brown areas are higher population density
- Green outline is Critical Habitat Designations for West Coast Salmon and Steelhead



Sources:
NASA, NOAA Fisheries

Most pesticide use in California is **non-agricultural**



California is the USA's leading agricultural state

Sources: CDPR databases, Moran et al.(2020)

Appendix B: CASQA / BACWA Presentation at EPA Environmental Monitoring Public Meeting

Non-agricultural uses of pesticides are ubiquitous

- Structural and landscape insecticides and herbicides
- Antimicrobial/ fungicides
- Industrial biocides
- Pesticides added to non-pesticide products, like building paint
- Disinfectants for drinking water and wastewater

Image credit: Tammy Qualls

Sources: CDPR databases, Moran et al. (2020)

Pesticides flow to surface waters through both indoor drains *and* outdoor runoff

Sewer

Storm Drain

Images sources: K. Moran, City of Palo Alto, and USGS

Pesticides create local agency liabilities

- Must comply with Clean Water Act
- Permit required for both wastewater and urban runoff discharges to Waters of the US
- Permit issuance requires ESA compliance

There are hundreds of current use pesticide impairments in CA alone, each requiring a Total Maximum Daily Load and discharge limit.

Ineffective mitigation example: Advanced water treatment

- Conventional treatment generally ineffective for pesticides
- Advanced treatment unrealistic
  - Costly and energy-intensive
  - No single treatment for all pesticides
  - Additional challenges with urban runoff due to large volume and episodic nature
  - Reverse osmosis concentrate can exceed toxicity thresholds for some pesticides, impacting disposal alternatives

Photo credits: City of Palo Alto

Sources: Sutton et al. (2019), UC Berkeley, Stanford, San Francisco Estuary Institute (2020).

Ineffective mitigation example: product label changes **for unlicensed/untrained users**

- Unlicensed/untrained pesticide users typically don't read product labels
- Users that do read labels, usually don't read application instructions

Types of urban pesticide users	Percentage of pesticide use by user type (CA)
Licensed applicators	Small (<2%)
Trained applicators (e.g., water/wastewater treatment plant operators)	About half
Unlicensed/untrained applicators	About half

Sources: Dugger-Webster A, et aj. (2018), Edworthy J, et al, (2004), Templeton, S., et al. (1998), Lockwood JA, et al (1994), Rother H-A, (2018),CDPR databases.

Mitigations that do work: **targeted** mitigation

- Pollution prevention is a common and effective mitigation approach
- Effective pollution prevention mitigation targets specific chemicals *and* particular users

Pollution Prevention *means eliminating or reducing the amount and toxicity of potentially harmful substances at their sources, prior to generation, treatment, off-site recycling or disposal. It emphasizes preventing or minimizing pollution, rather than controlling it once it is generated.*

Mitigation example 1: Fipronil for structural pest control CA Department of Pesticide Regulation

- Fipronil is toxic to aquatic invertebrates; monitoring data
- Modeled existing uses
  - Identified reductions needed to protect water quality
  - Identified primary source in urban runoff
  - Calculated reductions necessary
- Worked with users to confirm that proposed mitigation control pests

Image Source: Les Greenberg, UC Riverside

Focused, science-based label changes for *licensed* users expected to succeed

Source: Burant, A. et al. (2017).

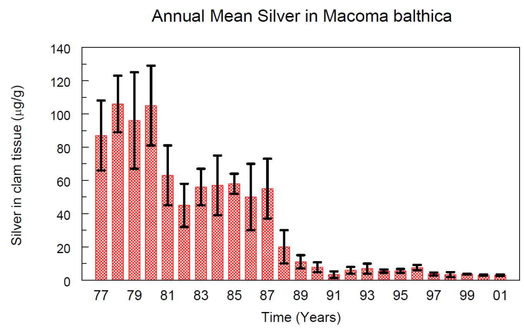
Mitigation example 2: silver in wastewater effluent

- Silver impairment identified in San Francisco Bay and other CA waters
- Silver and other metals impact clam population and size
- Desktop studies found the main silver sources were discharges to wastewater treatment plants from photo processing and silver plating
- Wastewater agencies developed targeted mitigation:
  - Effluent limits and monitoring for large users
  - Silver waste recovery, onsite treatment/offsite disposal for small photo processors

Malcoma balthica

Image credit: Chanda Brietzke & Jessica Brown, https://www.centralcoastbiodiversity.org/baltic-macoma-bull-macoma-balthica.html

Dramatic environmental response >95% silver reduction in clams and sediment near effluent discharge



Source: David, Carlos Primo C., et. al, (2002)

Mitigation example 3: Copper based root controls

- Copper impairment identified in the San Francisco Bay
- Single application **contaminates 20 million gallons of wastewater**
- Root control estimated at **5-12%** of the copper discharged to wastewater treatment plants.
- Mitigations and results:
  - Point-of-sale public outreach generated no measurable copper reduction
  - CA DPR identified pesticide and non-pesticide alternatives
  - CA DPR prohibited sale and use of copper-based root killers in the San Francisco Bay Area.
  - Monitoring data showed a nearly 25% reduction in copper levels after prohibition enacted

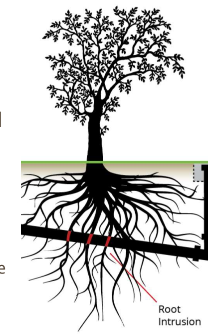


Image Source: Oro Loma Sanitary District

Mitigation example 4: tributyltin mitigation in cooling towers

- Wastewater effluent tributyltin (TBT) exceeded water quality standards in SF Bay
- TBT cooling tower biocide was only known wastewater discharge source
- Voluntary efforts unsuccessful as facilities managers proved unable to identify TBT products
- CA DPR identified many alternatives
- CA DPR prohibited sale and use of TBT cooling tower additives in the San Francisco Bay Area
- After implementation, wastewater TBT concentration below detection

Image credits: Kelly Moran

Mitigation example 5: urban runoff copper and lead

- CA and WA legislation requires copper to be removed from brake pads by 2025; became de facto law for all 50 states
- 60 percent of brake pads compliant as of 2022

Gas Pump Photo Attribution: Joe Mabel

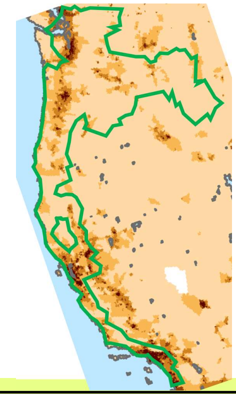
- Lead banned from gas in 1979 for air quality purposes
- Resulted in dramatic reductions in surface water concentrations

Numerous other examples of successful pollution protection programs

- **Pool, spa, and fountain** maintenance – eliminate fish kills by directing discharges to wastewater or open space like lawns
- **Dentists** – 45-75% reduction of mercury in wastewater biosolids after pollution prevention management practices program implemented in numerous US urban jurisdictions (locally-developed practices later became national EPA requirements)
- **Vehicle service facilities** – management practices to control metals, oils, solvents eliminated toxic stormwater and wastewater discharges
- **Restaurants** - grease traps eliminate sewage backups

Practical ESA mitigations specific to urban users are necessary, feasible, and cost-effective

- Endangered species are exposed to pesticides used in urban areas via wastewater and urban runoff
- Desktop studies and modeling can identify and prioritize specific urban pesticide uses for mitigation actions
- Advanced treatment of pesticides in wastewater and urban runoff is not a feasible pesticide mitigation strategy
- Pesticide label changes only effective for licensed & trained users
- Sale and use restrictions most effective mitigation option for products designed for unlicensed/untrained pesticide users



References

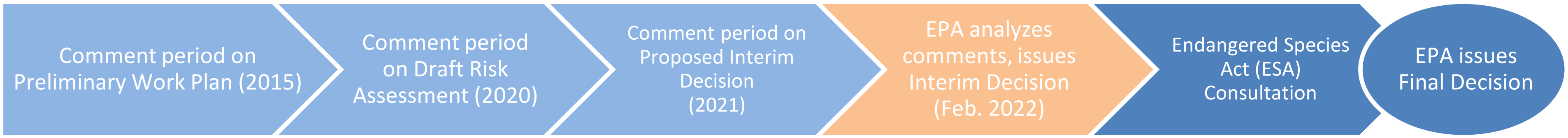
- Burant, A. et al. (2017). Surface Water Monitoring for Fipronil and California Mitigation Efforts. Presented at SWAMP symposium, Sacramento. Poster 42. https://www.cdpr.ca.gov/docs/emon/surfwtr/swposters.htm
- David, Carlos Primo C., et. Al. (2002). USGS Near Field Receiving Water Monitoring of Trace Metals in Clams (Macoma Balthica) and Sediments Near the Palo Alto Water Quality Control Plant in South San Francisco Bay, California: 1999-2001. https://pubs.usgs.gov/of/2002/ofr02453/ofr_final.htm
- Delaveau, Benoit (2011). The Environmental Impact Of The Retail Photoprocessing Industry In Santa Clara County: 1996 Vs. 2006. Master's Thesis. 3921. DOI: https://doi.org/10.31979/etd.mg7e-nkdn https://scholarworks.sjsu.edu/etd_theses/3921
- Dugger-Webster A, LePrevost CE. (2018). Following Pesticide Labels: A Continued Journey Toward User Comprehension and Safe Use, Current Opinion in Environmental Science & Health. doi: 10.1016/j.coesh.2018.03.004.
- Edworthy J, Hellier E, Morley N, Grey C, Aldrich K, Lee A. Linguistic and location effects in compliance with pesticide warning labels for amateur and professional users. Hum Factors. 2004 Spring;46(1):11-31. doi: 10.1518/hfes.46.1.11.30383. PMID: 15151153.
- Lockwood JA, Wangberg JK, Ferrell MA, Hollon JD. Pesticide labels: proven protection or superficial safety? J Am Optom Assoc. 1994 Jan;65(1):18-26. PMID: 8132948.
- Moran, K., Anderson, B., Phillips, B., Luo, Y., Singhasemanon, N., Breuer, R. and Tadesse, D. (2020), Water Quality Impairments Due to Aquatic Life Pesticide Toxicity: Prevention and Mitigation in California, USA. Environ Toxicol Chem, 39: 953-966. https://doi.org/10.1002/etc.4699CDPR databases, https://www.cdpr.ca.gov/dprdatabase.htm
- NASA, Population Density map: https://earthobservatory.nasa.gov/images/7052/united-states-population-density
- NOAA Fisheries, NOAA Fisheries Outline of Critical Habitat Designations for West Coast Salmon and Steelhead, https://www.fisheries.noaa.gov/resource/document/status-esa-listings-and-critical-habitat-designations-west-coast-salmon-and
- Rother H-A, Pesticide Labels: Protecting Liability or Health? – Unpacking "misuse" of pesticides, Current Opinion in Environmental Science & Health (2018), doi: 10.1016/j.coesh.2018.02.004.
- Sutton et al. (2019). Occurrence and Sources of Pesticides to Urban Wastewater and the Environment. Goh et al.; Pesticides in Surface Water: Monitoring, Modeling, Risk Assessment, and Management ACS Symposium Series; American Chemical Society: Washington, DC, 2019.
- Templeton, S., D. Zilberman, and S. J. Yoo. (1998). An Economic Perspective on Outdoor Residential Pesticide Use. (R823342). Environmental Science & Technology. American Chemical Society, Washington, DC, 2(17):416-423.
- TriTAC comment letter to EPA, Docket ID Number EPA-HQ-OPP-2005-0558: Coppers Risk Assessments (March 27, 2006)
- UC Berkeley, Stanford, & San Francisco Estuary Institute (2020). Reverse Osmosis Concentrate Treatment Research Results and Context for San Francisco Bay. https://www.valleywater.org/sites/default/files/ROC_TechMemo_ETC_Research_0.pdf

Appendix C

Regulatory Participation Outcomes
and
Effectiveness Assessment Summary Tables

Table of Contents

Pesticide: Creosote – EPA-HQ-OPP-2014-0823
Why we care: 303(d) listings (PAHs); Contains CWA Priority Pollutants (PAHs); UP3 Priority (toxicity; use patterns)
Actions taken: CASQA sent a comment letter to EPA on the creosote Proposed Interim Decision (PID) on May 19, 2021.
Status: EPA released the Interim Registration Review Decision (ID) in February 2022.



Next steps: EPA will complete an endangered species determination and any necessary consultation with the Services.
Recommendation: No action needed at this time as there is no open comment period.

CASQA 5/19/2021 Comments to EPA	EPA Response	Did EPA incorporate CASQA's comment?
EPA did not provide a draft ecological risk assessment for creosote, and did not produce required ecological studies that the EPA itself said were required. (see p.12 of EPA's Proposed Interim Decision)	"*The Agency does not support delaying the issuance of this interim registration review decision while ecological data are being generated, citing the important mitigation measures that will protect workers."* (Response to Public Comments on the Creosote Proposed Interim Decision, Dec 8, 2021, p.8)	No.
In addition to careful review and consideration of the required studies, the risk assessment should include surface water modeling using EPA's PRZM/VVWM runoff model, running under the current version of the Pesticide in Water Calculator (PWC), and including the right-of-way (ROW) scenario.	"*The Agency appreciates the suggestion; however, it believes there is no appropriate scenario available for the wood preservative use in the PWC. The Agency will consider the development of such a scenario in the future and is currently working on refining the modeling approaches used for estimating environmental exposures for antimicrobial pesticides."* (Response to Public Comments on the Creosote Proposed Interim Decision, Dec 8, 2021, p.8)	Partially, but only for consideration of future antimicrobial pesticide evaluations.
An updated ecological risk assessment for creosote should include a survey of available monitoring data for potentially toxic components of creosote, including PAHs. Such a survey should include data available from the Water Quality Data Portal (https://www.waterqualitydata.us/portal/), as well as additional data available from the California Department of Pesticide Regulation	"*The Agency acknowledges that PAHs are commonly detected in water monitoring data, but aquatic exposure of these compounds is associated with numerous sources including pavement, oil, and gas activities, use of coal tar sealants, storm sewer runoff, tire wear, and burning of fossil fuels and wood. As a result, the Agency cannot attribute water detections of*	No.

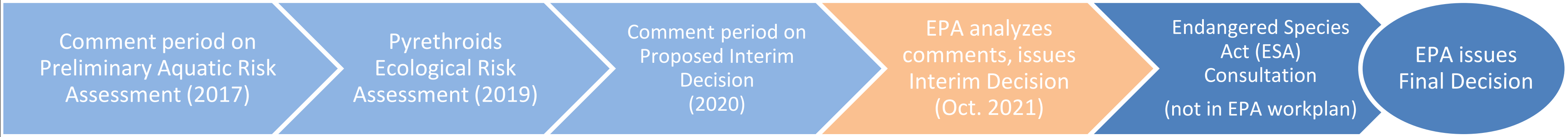
(CDPR) surface water (“SURF”) database. PAH compounds are very commonly detected in samples of urban runoff and urban receiving waters.	*PAHs to registered creosote uses in many cases, as was discussed in the DRA.”* (Response to Public Comments on the Creosote Proposed Interim Decision, Dec 8, 2021, p.8)	

Pesticide: Cyhalothrins (Gamma and Lambda) – EPA–HQ–OPP–2010–0479 and EPA–HQ–OPP–2010–0480

Why we care: Priority pesticide due to toxicity, use, and monitoring data. Multiple 303(d) listings as well as adopted and pending TMDLs.

Actions taken: CASQA sent a comment letter to EPA on the cyhalothrins Proposed Interim Decision (PID) on January 11, 2021. In February 2020, CASQA also sent a comment letter to EPA on the Pyrethroids and Pyrethrins Ecological Risk Mitigation Proposal.

Status: EPA released the Interim Registration Review Decision (ID).



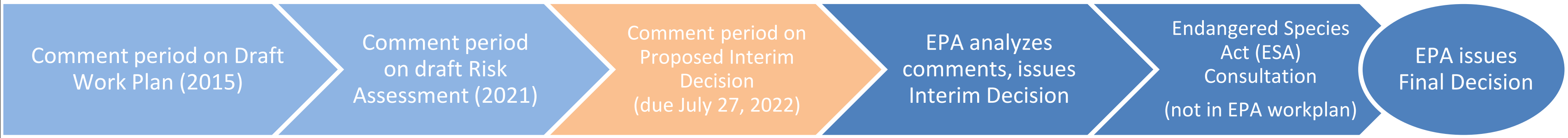
Next steps: EPA will complete an endangered species determination and any necessary consultation with the Services.

Recommendation: No action needed at this time as there is no open comment period.

CASQA 1/11/2020 Comments to EPA	EPA Response	Did EPA incorporate CASQA's comment?
CASQA strongly supports the "Required Label Language for Lambda-and Gamma-Cyhalothrin End-use products with outdoor, urban, non-agricultural uses". As defined in PID Appendix B, pp. 88-90, as a minimum level of mitigation required to address the known risks to aquatic species from outdoor / urban uses of cyhalothrins.	No direct response.	Yes, EPA kept the label language from the PID in the ID.
However, the Cyhalothrins PID does not provide any additional mitigation measures…to address the documented impacts of pyrethroid use in urban (non-agricultural) areas, and the risks to aquatic life of continued use of pyrethroid pesticides. This is despite significant evidence presented both in EPA's risk assessments and in our previous comment letters…consideration for possible additional mitigation measures should be afforded for each pyrethroid known through documented sources to contribute to surface water pollution.	"The Agency appreciates the comments from CASQA, SFBRWQCB, and BACWA. The Agency issued a single risk mitigation proposal to address ecological risks for 23 pesticides, which encompass the pyrethrins, synthetic pyrethroids, and pyrethroid-like insecticides, because they exhibit a common insecticidal mode of action and show similar ecological effects. Additionally, assessing these pesticides as a group would ensure a consistent approach to mitigating potential ecological risk, including providing equity to stakeholders, when implementing regulatory changes for pesticides in this group. EPA conducted a separate human health risk assessment for each chemical to account for different exposure pathways and human toxicity. The Agency has decided not to develop unique chemical-specific ecological risk mitigation for lambda-cyhalothrin and gamma-cyhalothrin at this time beyond what is already required as part of this ID. The Agency concludes that lambda-cyhalothrin and gamma-cyhalothrin provide high benefits for	No.

	controlling pests in indoor residential areas, outdoor urban areas, in agricultural crop production, and as an adult mosquito adulticide to control vectors for human disease. The Agency is requiring risk mitigation primarily to address risk to non-target invertebrates and fish. However, risks may remain to non-target organisms even after mitigation. Any remaining risks are outweighed by the benefits of lambda-cyhalothrin and gamma-cyhalothrin use." (ID, pp. 14-15)	
CASQA recommends the following enhancements to the proposed label language specified in Appendix B of the PID: • design a clear schematic graphic for product labels to completely and effectively address prevention of product spilling or dumping into gutters and storm drains • review proposed label language text, and edit as needed to provide clear and consistent descriptions of pervious and impervious surfaces, to ensure clarity with respect to allowable exceptions, including with respect to applications to vertical surfaces, and • provide California-specific labels for outdoor structural pest control pyrethroids products that are completely consistent with California Surface Water Protection Regulations implemented by California Department of Pesticide Regulation.	"…the Agency notes that all states, including California, are authorized to restrict pesticide use according to state requirements and standards." (ID, pp. 15)	No.

Pesticide: Diuron – EPA–HQ–OPP– 2015–0077
Why we care: Fungicide/antimicrobial used in building products, including paint, caulks, and sealants. Also an herbicide. Highly toxic to aquatic life.
Actions taken: CASQA sent a comment letter to EPA on the Draft Ecological Risk Assessment (Draft RA) on May 7, 2021.
Status: EPA released the Proposed Interim Registration Review Decision (PID).



Next steps: EPA will issue an Interim Decision.
Recommendation: It is recommended that CASQA write a brief comment letter on the Diuron PID.

CASQA 5/7/2021 Comments to EPA (excerpt)	EPA Response	Did EPA incorporate CASQA's comment?
A Chronic Sediment Toxicity Study Is Needed for Aquatic Invertebrates CASQA therefore requests that the risk assessment be amended to include consideration of the results of a sediment toxicity study for freshwater invertebrates.	EPA is cancelling all conventional (herbicidal) uses of diuron, so they state that this chronic sediment toxicity study is not needed.	No. While CASQA supports the cancellation of the conventional uses, it will remain important to complete the chronic sediment toxicity study for aquatic invertebrates due to the antimicrobial uses of diuron. EPA's evaluation of diuron for antimicrobial uses is continuing on a separate review schedule, for which CASQA last provided comments to the Draft RA in June 2021.
Monitoring Data Summaries Are Incomplete and Understate Diuron Surface Water Levels It is important for the risk assessments to include fully representative data for diuron in surface waters, particularly because the CDPR dataset includes a range of concentrations higher than those reported in EPA's monitoring summaries. We therefore request that the Draft ERA and Antimicrobials RA be amended to incorporate the CDPR SURF data for diuron.	None.	No.

Toxicity Endpoints Used in Diuron Risk Assessments Do Not Agree Across EPA Sources The toxicity endpoints used in EPA's modeling for the Draft ERA and Antimicrobials RA are not consistent, and the endpoints used in both documents are not in agreement with the Aquatic Life Benchmarks for Pesticides published on EPA's web site.	"*The Agency appreciates the comments and acknowledges that there are inconsistencies in the Draft Risk Assessment for the antimicrobial uses of diuron. These inconsistencies will be addressed in the amended diuron risk assessment*." (Response to Public Comments on N'(3,4-dichlorophenyl)-N,N-dimethylurea (Diuron) Draft Risk Assessment on the Antimicrobial Use, p.6)	Yes.

Pesticide: Malathion – EPA-HQ-OPP-2009-0317

Use: Insecticide

Why we care: Malathion occurs in urban watersheds at concentrations above EPA's malathion water quality criterion.

Actions taken: CASQA commented on the Draft Biological Evaluation on June 10, 2016, the National Marine Fisheries Service Biological Opinion on July 23, 2018, and the US Fish and Wildlife Service Draft Biological Opinion on June 18, 2021.

Status: The National Marine Fisheries Service Endangered Species Act Section 7 Conference and Revised Biological Opinion was released June 30, 2022.

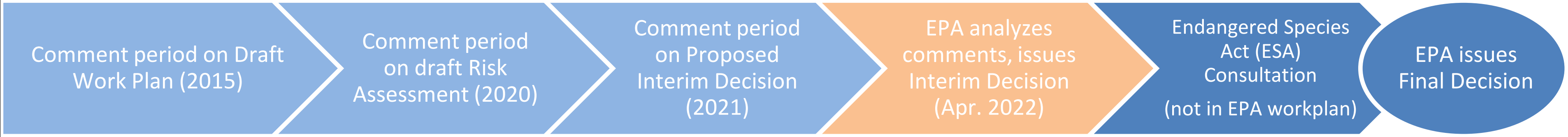
Recommendation: No action is needed at this time as there is no further opportunity for public comment.

CASQA Comments to EPA (June 2016, July 2018, and June 2021)	EPA Response (National Marine Fisheries Service Endangered Species Act Section 7 Conference and Revised Biological Opinion)	Did EPA incorporate CASQA's comment?
Occurrence of malathion Clean Water Act 303(d) listings in urban water bodies is consistent with BiOp finding of adverse modification of critical habitat. Clean Water Act compliance assessments must be an integral part of BEs and Registration Review ecological risk assessments.	They acknowledged this linkage. (p. 718)	No.
Evaluation of the proposed Reasonable and Prudent Alternatives (RPAs) in the context of urban (developed) areas. We highlight RPA approaches that are impractical or ineffective in the urban context and suggest alternatives. Mitigation is needed specifically for malathion impacts to aquatic life in developed watersheds. Suggested RPAs (through label modification) include: • Restrict malathion use in non-agricultural settings to professional applicators. • Restrict applications in urban use sites to avoid impervious surfaces	"EPA and applicants agreed to modify the action to incorporate the draft RPA measures for all non-broadcast applications that occur within 300 m of specified ESA-listed species habitats." (p. 897) They acknowledged that there is "limited use and exposure data on stressor of the action for non-agricultural uses of these pesticides" and "(u)ncertainty about pesticide concentrations resulting from non-agricultural uses". (p. 1195) The report includes language to limit application on impervious surfaces (p. 131-132): • Do not apply within 25 feet of aquatic habitats (such as, but not limited to, lakes, reservoirs, rivers, permanent streams, wetlands or natural ponds, estuaries, and commercial fish farm ponds).	Unclear. Although the language limiting the use of malathion on impervious surfaces is comprehensive, the language only applies within 300 meters of ESA-listed species habitats. It is unclear how EPA plans to implement this language. It is also not clear if the 300 meter limitation also includes non-agricultural sites,

	• Do not apply directly to, or allow the product to enter sewers or storm drains, or to any area like a drain or gutter where drainage to sewers, storm drains, water bodies, or aquatic habitat can occur. • Do not apply directly to impervious horizontal surfaces such as sidewalks, driveways, and patios except as a spot or crack-and-crevice treatment. • Do not apply to vertical surfaces directly above pervious or impervious surfaces that drain into ditches, storm drains, gutters, or surface waters. • Do not apply or irrigate to the point of runoff. However, this language appears to be limited to areas within 300m of specified ESA-listed species habitats.	and even if it is inclusive, it is not known how an unlicensed user would be able to determine if their location was within 300 meters of an ESA-listed habitat prior to using malathion.
Non-agricultural pesticide usage data. We share our analysis of California pesticide sales data, use data, and water quality monitoring data that suggests that most malathion in urban runoff likely stems from products sold at retail to non-professional users.	The report acknowledged CASQA's comment. (p.9) They reference CA DPR monitoring data, (p. 626 and p. 1344)	Partially
A BE is not a replacement for a Registration Review ecological risk assessment. An Ecological Risk Assessment is needed for malathion.	The document makes claims that they "followed an ecological risk assessment framework." (p.8)	No. The "framework" is not the same as an Ecological Risk Assessment.
The format of the public review documents was too complex, even for a nationwide BE.	No response.	No.
CASQA supports implementation of the Conservation Recommendations included in the FWS Biological Opinion, especially the following, which bear on issues relating to the presence and effects of malathion and other pesticides in the urban environment: 4. Work with other appropriate Federal, state, and local partners to study the efficacy of conservation practices in reducing pesticide loading to streams, lakes, wetlands, sinkholes, and other terrestrial and aquatic habitats from off-site transport.	It does not appear that they are going forward with any of these conservation measures. They cited other conservation measures, but did not reference these conservation measures (4-7) in the report.	No.

5. Develop methods and models that better describe and quantify pesticide persistence and fate and transport to assist in analyses for future pesticide consultations. 6. Develop methods to better understand and quantify pesticide exposure from non-agricultural uses. 7. Develop criteria that address when pesticide-contaminated sediment is an important route of exposure to aquatic or terrestrial organisms. [Biol. Op. pp. 519-520]		

Pesticide: Oxadiazon – EPA–HQ–OPP–2014–0782
Why we care: Herbicide applied in outdoor urban settings.
Actions taken: CASQA sent a comment letter to EPA on the Proposed Interim Decision (PID) on October 4, 2021.
Status: EPA released the Interim Registration Review Decision (ID) in April 2022.



Next steps: EPA will issue an Interim Decision.
Recommendation: CASQA will continue to monitor this pesticide. No opportunity for comment at this time.

CASQA 10/4/2021 Comments to EPA (excerpt)	EPA Response	Did EPA incorporate CASQA's comment?
CASQA Supports Proposed Mitigation for Oxadiazon. These uses include terminating most turf applications, prohibiting liquid applications, reducing amount of remaining applications, adding a non-target organism advisor notice, updating and standardizing the environmental hazard and groundwater/ surface water advisory statements	*"EPA thanks CASQA for its comments on the oxadiazon PID. In response to new information and proposals received during the public comment period, EPA has made several changes to the proposed mitigation originally presented in the PID and encourages CASQA to review these changes. Details of these changes are provided in Section IV.A. These updates provide additional flexibilities to users linked to additional requirements (e.g., classification of oxadiazon as an RUP and instructions directing the user to thoroughly irrigate after application as soon as possible on the same day of application) while still adequately protecting drinking water sources. EPA has determined that the revised mitigations would substantially reduce potential for surface water runoff and impacts to non-target aquatic organisms while still adequately preventing unreasonable adverse risks to human health."* (Oxadiazon Interim Registration Review Decision, Case Number 2485, March 2022, pp.15-16) "*There were five mitigations proposed in the PID that EPA has determined are no longer needed in the ID. EPA originally proposed terminating all turf uses except for golf course fairways and sod farms to address post-application risks of concern. Due to the new label language needed that instructs the user to water-in as soon as possible after application, the anticipated requirement for new TTR data with watering-in, and the revised mitigation on golf courses allowing treatment on up to 30% of all managed turf surfaces, EPA will not require these proposed terminations at this time. EPA originally proposed cancelling the end use product registered for tees and greens (EPA Reg. No. 9198-176) to address drinking water risks of concern. EPA has decided on a 30% golf course turf area restriction instead (Mitigation #7), which will allow continued use on tees and greens, and therefore allow EPA Reg. No. 9198-176 to remain registered."* (Ibid. pp. 44-48)	Partially. Although they went back on several of the mitigations that they had proposed, including allowing some uses on turf, they did keep some of the mitigations that are significant to the urban environment, including the proposed ban on liquid applications in the urban environment.

Pesticide: Permethrin (EPA–HQ–OPP–2011–0039),

Use: Insecticides

Why we care: Priority pesticide due to toxicity, use, and monitoring data. 303(d) listings as well as adopted and pending TMDLs.

Actions taken: In February 2020, CASQA sent a comment letter to EPA on the Pyrethroids and Pyrethrins Ecological Risk Mitigation Proposal. In May 2020, EPA released a Proposed Interim Decisions for permethrin. In December 2021, CASQA sent a comment letter on the antimicrobials draft risk assessment for permethrin.

Status: EPA issued the 2nd Amendment to the Permethrin Interim Registration Decision on March 16, 2022.

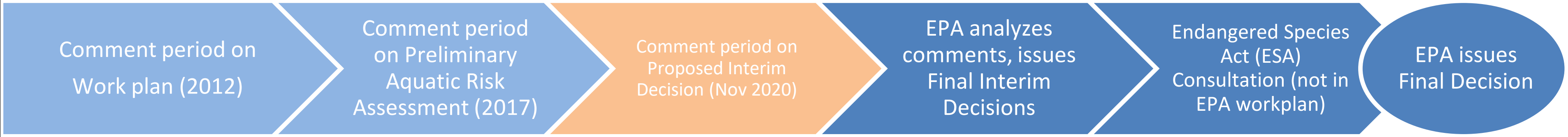
Next steps: The Endangered Species Act Consultation is the next step in the process.

Recommendation: CASQA will continue to monitor the permethrin docket. There is no opportunity for comment at this time.

CASQA 12/28/2021 Comments to EPA	EPA Response	Did EPA incorporate CASQA's comment?
"We question the assumption that "exposure to aquatic areas from terrestrial uses is expected to be negligible". Permethrin can be transported to surface waters from terrestrial wood preservative uses – specifically fences and decks…" The CASQA comment goes on to document transport over pervious and impervious surfaces. "Assuming similar leaching rates during rainfall events, and efficient transport of suspended permethrin in runoff through the storm drain system directly to a surface water body, the risk to aquatic species from permethrin-treated wood structures in impervious surface settings could be similar to the risks identified in the Draft RA for the dock/lake scenario."	"As described in Section 3.3.1 Terrestrial and Aquatic Exposure Profile in the DRA, "given the low leaching rate (0.0125 %/day, MRID 49638201) from treated wood that is limited by the water solubility (0.0055 mg/L, 5.5 ug/L, Table 1) and the expected sorption to soil (MRID 41868001), exposure to terrestrial and aquatic organisms is expected to be negligible if treated wood is used in a terrestrial setting." (2nd Amendment to Permethrin Interim Registration Review Decision, Case Number 2510, March 16, 2022. p. 4)	Partially. EPA acknowledges CASQA's comment on leaching, but did not model the specific scenario, relying on estimates based on the water solubility and expected sorption instead.

“Modeling is Needed for Terrestrial Wood Preservative Uses. CASQA recommends that EPA use available PWC scenarios to model the terrestrial wood preservative uses of permethrin prior to publishing a final risk assessment or proposed interim decision.”	“Additionally, guidance in the 2020 American Wood Protection Association (AWPA) Book of Standards indicates that permethrin is not intended for use in aquatic environments such as docks or for ground contact such as fences.” (2nd Amendment to Permethrin Interim Registration Review Decision, Case Number 2510, March 16, 2022. p. 4)	Partially. Although the American Wood Protection Association’s Book of Standards indicates that permethrin is not intended to be used for these uses, the fact remains that there are labeled permethrin pesticides for these uses. It is unclear if the registrants intend to withdraw these label uses but no further changes were listed in this 2nd Amendment to the EPA’s Permethrin ID.
“Mitigation Is Needed. CASQA requests that EPA develop a program of mitigation to reduce the potential for negative impacts to aquatic organisms from the terrestrial wood preservative uses of permethrin.”	See above.	Partially. If the registrants pull products that are of concern. (see above)

Pesticide: Pyrethrins – EPA–HQ–OPP–2011–0885
Use: Insecticide
Why we care: Related to pyrethroids, but less toxic and less stable
Actions taken: CASQA commented on the Ecological Risk Mitigation Proposal (February 2020).
Status: EPA released the Proposed Interim Registration Review Decision (PID) (August 2021).



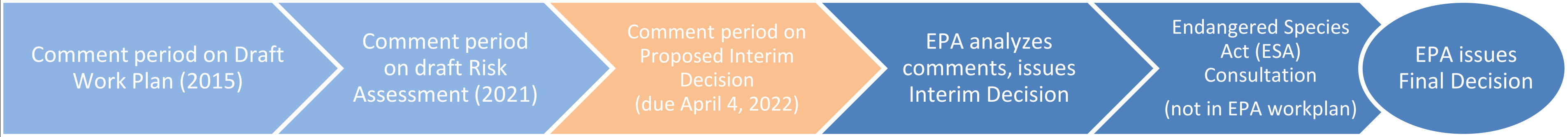
Next steps: ESA Consultation is required but unlikely to begin before 2022.
Recommendation: Send comment letter to EPA supporting the proposed mitigations to pesticide label language.

CASQA Comments to EPA	EPA Response	Did EPA incorporate CASQA's comment?
EPA's risk / benefit finding should be revised to differentiate among the 23 pyrethroids and pyrethrins and among the various outdoor urban uses of the 23 chemicals	"The pyrethroids have many uses across agricultural, residential, commercial, indoor and outdoor sites, and were grouped into broad categories to compare the potential exposure for those active ingredients that were not quantitatively assessed in the 2016 Ecological Risk Assessment…. For the purposes of risk-benefit analysis, and EPA considers this approach to provide adequate differentiation among uses assessed for the group of 23 chemicals. Among outdoor uses, EPA is aware of the potential for applications to impervious surfaces to contribute to waterway pollution. The Agency's mitigation for outdoor non-agricultural use as a category is reflective of those risk contributions. The Agency disagrees that a separate analysis of each pyrethroid or each specific use is needed to support EPA's risk assessment and risk management conclusions" "EPA's risk assessment supports the conclusions that there are risks of concern for aquatic organisms from exposure to pyrethroids, which is supported by water monitoring data that indicate that pyrethroids are present in the environment that result in adverse effects to aquatic invertebrates. The benefits from the use of these chemicals for these uses is also very high."	No.

EPA should ban outdoor urban use of Bifenthrin (separate pesticide from pyrethrins, but CASQA's comments were in response to a Risk Assessment that include both pyrethrins and pyrethroids).	"EPA… disagrees that a representative analysis featuring bifenthrin is necessary, as bifenthrin is not outstanding among pyrethroids in terms of RQ exceedances, aquatic invertebrate toxicity, or environmental persistence."	No.
Label change: CASQA supports prohibition on applications during rain	EPA incorporated suggested comment.	Yes.
Label change: CASQA supports advisory statement to avoid applications if rain is forecast within 24 hours	EPA incorporated suggested comment (although CASQA would prefer an enforceable statement via a word such as "prohibition").	Yes.
Label change: CASQA supports addition of water protection statements	EPA incorporated suggested comment.	Yes.
Label change: CASQA supports definition of spot treatment (2 sq. ft.)	EPA incorporated suggested comment.	Yes.
Label change: CASQA supports requirement that product labels explicitly state whether particular products are allowed to be used indoors only, outdoors only, or both indoors and outdoors	EPA incorporated suggested comment.	Yes.
Label change: CASQA supports reduction in height above ground level of building treatments from 3 feet to 2 feet	EPA incorporated suggested comment.	Yes.
Label change: CASQA requests that EPA identify a specific outdoor drain graphic and require the same graphic be used on all products.	"Regarding the suggestion…to add the down-the-drain advisory statements to all pyrethroids/pyrethins labels (both agricultural and non-agricultural), outdoor and agricultural product labels already have label statements to prevent these chemicals from reaching drainage systems. In contrast, products with indoor uses do not currently have this language. Therefore, EPA has determined that these down-the-drain advisory statements are only necessary on products with indoor uses. However, registrants have the option to consider including this language (i.e., "unless for use in pipes and sinks") to agricultural product labels at their discretion." (Pyrethroids and Pyrethrins Revised Ecological Risk Mitigation and Response to Comments on the Ecological Risk Mitigation Proposal For 23 Chemicals, p. 7)	No.

Label change: CASQA requests that EPA establish minimum size for the outdoor graphic, to ensure that it is legible, i.e., no smaller than 1.5 square centimeters unless this size is greater than 10% of the size of the label.	EPA incorporated CASQA's comment on graphic sizing for the indoor graphic, which helps fellow agencies such as BACWA.	Partially incorporated.
Label change: CASQA requests that EPA include Spanish translation for the outdoor drain discharge prohibition ("Do not allow the product to enter any drain during or after application."), and include this language on all outdoor non-agricultural products.	EPA incorporated suggested comment.	Yes.

Pesticide: Ziram – EPA-HQ-OPP-2015-0568
Why we care: Fungicide/antimicrobial used in building products, including paint, caulks, and sealants. Highly toxic to aquatic life.
Actions taken: CASQA sent a comment letter to EPA on the Draft Ecological Risk Assessment (Draft RA) on January 19, 2021.
Status: EPA released the Proposed Interim Registration Review Decision (PID).



Next steps: EPA will issue an Interim Decision.
Recommendation: It is recommended that CASQA write a brief letter of support of the cancelation of Ziram in all paint products as well as additional controls placed on the non-paint uses (caulks, sealants) of Ziram.

CASQA 1/19/2021 Comments to EPA	EPA Response	Did EPA incorporate CASQA's comment?
Based on EPA's analysis, there is risk to freshwater invertebrates (and fish) when fairly small amounts of ziram are applied in a given watershed…If even a small fraction of those buildings are painted with paint containing ziram in a given year, and if even a fraction of the ziram contained in that paint leaches to a surface water body, freshwater invertebrate (and fish) life could be impacted. Rather than speculating, EPA should modify its risk assessment analysis for freshwater invertebrates analytically, and with full documentation. This may require acquisition of additional data to perform an accurate assessment.	"*The Agency thanks CASQA for their comment. The Agency agrees that additional data would allow for a more refined assessment of risks to aquatic invertebrates from the use of ziram in paint. However, because the Agency relied on a screening-level risk assessment using conservative assumptions, additional analyses are not likely to result in a higher risk than determined in the DRA. Therefore, the Agency maintains its conclusions of no expected risks to aquatic invertebrates from the ziram paint use.*" (Registration Review Response to Comments on the Ziram DRA for Antimicrobial Uses, March 9, 2021, p.2)	**Partially.** EPA agrees that additional study would be useful, but ignores CASQA's comment about the impact of Ziram-containing paint in urban environments. However, due to human health effects, EPA is proposing cancellation of the paint preservative uses of ziram as well as additional controls for non-paint materials preservative uses of ziram.

The potential risk to sediment-dwelling aquatic invertebrates is incomplete, as the Draft EPA contains…confusing and contradictory language. CASQA therefore requests that the risk assessment be amended to include consideration of the results of a sediment toxicity study for freshwater invertebrates.	"*As mentioned in Section 1.5 of the draft risk assessment, a chronic spiked-sediment study with thiram (using either an amphipod or chironomid) could help to determine if added risk may also come from exposure to contaminated sediment. EFED acknowledges that chronic toxicity data for sediment (benthic) invertebrates were not available at the time of the assessment because sediment toxicity studies were not requested in the respective problem formulations. Potential chronic risk to benthic invertebrates were evaluated using water-column invertebrate toxicity data as surrogates and potential chronic risk was identified. Some uncertainty is acknowledged as to whether benthic aquatic invertebrates may need further evaluation using sediment-based toxicity data given the complex fate characteristics of the chemicals. However, because potential chronic risk based on sediment pore water exposure and surrogate toxicity data was identified, EFED acknowledges that the data would help inform future risk assessments*." (Thiram, Ferbam, and Ziram: EFED Response to Comments on the Draft Ecological Risk Assessment, March 24, 2021, p.18)	Partially. EPA acknowledges that CASQA is correct but is not requiring the registrant to provide the needed data. However, due to human health effects, EPA is proposing cancellation of the paint preservative uses of ziram as well as additional controls for non-paint materials preservative uses of ziram.